The Future of Learning

How colleges can transform the educational experience
Expect more from your LMS


To learn more visit D2L.com
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Page</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Executive Summary</td>
</tr>
<tr>
<td>6</td>
<td>Introduction</td>
</tr>
<tr>
<td>10</td>
<td>Section 1: Student Success</td>
</tr>
<tr>
<td>24</td>
<td>Section 2: Innovations in Teaching</td>
</tr>
<tr>
<td>38</td>
<td>Section 3: Managing Change</td>
</tr>
<tr>
<td>50</td>
<td>Index</td>
</tr>
<tr>
<td>52</td>
<td>Conclusion</td>
</tr>
</tbody>
</table>

---

**About the Author**

Beth McMurtrie covers innovation in teaching and the future of learning as a senior writer at *The Chronicle of Higher Education*. In 19 years there, she has written about a range of topics, including scholarship, entrepreneurship, economic divides, campus culture, diversity, and religion. For eight years she was *The Chronicle*'s international editor, directing coverage of foreign higher education and the global activities of U.S. institutions. She has won honors from the Education Writers Association, including for writing an article on why colleges haven’t stopped binge drinking and editing a series on the growth of higher education in Asia.
Imagine the future of learning. You might picture students strapping on headsets as their professors transport them to virtual worlds. Or maybe you see a robot in front of a class. The truth is, changes to higher education in the next decade are likely to be less sci-fi but more profound than that.

Your average student won’t be entering an alternate reality in History 101 anytime soon. But other innovations are emerging. Big data and analytics are predicting his academic performance and nudging him to improve it. Robots are functioning not as teachers, but as chatbots to enhance tutoring or advising. Meanwhile, professors are trying new forms of and tools for teaching that turn the traditional lecture on its head, more deeply engaging students and helping them grasp vital concepts.

These developments are part of a broader student-success movement in higher education. Public skepticism over quality and value has opened the black box of college. As academic leaders peer inside, they are asking fundamental questions that could spark major transformations. How do students learn best? What role can technology play? And what is it about the academic experience that confuses and frustrates so many students?

College leaders need to identify and remove those barriers and create new opportunities for learning at their institutions. That calls for self-study, experimentation, and innovation to help all students achieve their potential and to prepare them for a complex, fast-changing world.

Section 1
Student Success

Rising college costs, lagging graduation rates, and disparate outcomes by race, ethnicity, and income have increased scrutiny of higher education. The student-success movement aims to raise retention rates and close gaps in academic performance. Some innovative colleges are deploying big data and predictive analytics, along with intrusive advising and guided pathways, to try to engineer a more effective educational experience. Experiments in revamping gateway courses, better connecting academic and extracurricular work, and lowering textbook costs also hold promise to support more students through college.
Section 2
Innovations in Teaching

Technology has become an integral part of the college class. Professors are introducing innovations like flipped classrooms, active learning, and adaptive courseware to engage students and help them learn. Even colleges without resources to spare are trying to encourage experimentation among faculty members and provide sufficient training and support to expand it beyond early adopters. While some techniques — driven by technology or pedagogy — show signs of improving learning, more research is needed to distinguish hype from results.

Section 3
Managing Change

To promote innovation, academic leaders must confront structural, financial, and cultural barriers. Departments and divisions continue to operate independently on many campuses, hampering a holistic approach to student success. Reforms to teaching require investments in training and personnel. And colleges are fundamentally conservative institutions that may not sufficiently encourage, support, and reward risk-taking. Leaders must be mindful of these challenges, make strategic bets, consider ethical dilemmas, and remember that technology is a tool, not a solution.
Many of today’s academic leaders came of age when the message to college students was: “Sink or swim.” They sat in large, impersonal lectures. Skimmed confusing course catalogs. Waited in long lines at the registrar’s office. Those were staples of the college experience — and often still are.

Academic rigor was measured in part by the number of students who flunked, typically in courses that served as gateways to a major — say in math or chemistry. To get help, you had to make your way to a tutoring center that might have been difficult to find, if you even knew it existed. If an adviser noticed poor grades, he may have questioned whether you were cut out for college.

Your success or failure, in short, was a reflection of you — not your institution.

This system worked in large part because of two things: College was a ticket to the middle class, and it didn’t cost too much. Professors could focus on teaching their disciplines because they were part of an economy that valued specialization and credentialing. Students could wander through the curriculum, switch majors a couple of times, graduate without too much debt, and land a decent job. College was a black box that took in unformed teenagers and turned out able adults.

The attitude among presidents, provosts, and professors was “Trust us.” And people did.
Fast forward three or four decades, and you won’t find many Americans willing to extend that courtesy. Faith has yielded to doubt. A prevailing narrative is that higher education in the United States, from community colleges to the Ivy League, is failing its students.

It is failing them because it’s too expensive. Because it sees too few through to graduation. Because teenagers from low-income backgrounds or who are the first in their family to go to college perform worse than their peers. Because higher education offers inadequate preparation for today’s complex economy.

More than a decade of government-led accountability efforts, combined with some damning reports on what students are or aren’t learning, have fueled skepticism of a once-revered system. The rise of big data and sophisticated algorithms and the ubiquity of the internet have also changed public expectations about what is possible in an era of mass production. If health care and business can personalize the experience of millions of patients and customers, why can’t higher education do the same for students?

The traditional approach is no longer good enough. For the first time in many years — maybe ever — a significant minority of Americans (and a majority of Republicans) think colleges and universities have a negative effect on the nation.

That’s the bad news. The good news is that colleges are starting to do something about it. They realize they must restore their public standing, give all students a fair shot, make the system less confusing, and prepare graduates to thrive in a fast-changing world.

“We’re moving from mass production to mass personalization,” says Dale Johnson, who runs a new type of educational program known as adaptive learning at Arizona State University, a leading innovator.

To understand disparities in academic performance, colleges are mining student data to figure out who is faltering, when, and why. To shore up retention, faculty and staff members are adding academic supports and revamping those gateway courses. To help students graduate on time, institutions are creating pathways, or highly structured course sequences, that limit confusion and

If health care and business can personalize the experience of millions of patients and customers, why can’t higher education do the same for students?
wandering. To control costs, colleges are tapping into free materials that can replace pricey textbooks.

What’s happening inside the classroom is changing as well. The professor, the saying goes, is moving from the sage on the stage to the guide on the side. Rather than simply filling students’ heads with information through lectures — there’s Google for that — she is helping them grasp complex ideas through active learning. She instructs them not just in class, but also online, so they can advance at their own pace or manage complicated schedules. She’s using technology to stimulate learning in new and creative ways, through active spaces and adaptive techniques. And she is helping students make connections between what’s in their readings and in their communities, to develop the skills they need to thrive in the 21st century.

All of that is a tall order, but more colleges are investing in new systems and developing new capabilities to pull it off. “You don’t get innovation without infrastructure,” says Kenneth C. Green, head of the Campus Computing Project, which studies the role of technology in higher education.

For college leaders, the marked shifts in public perception, costs, pedagogy, and technology present opportunities as well as risks. An effective analytics system may reveal weaknesses that institutions themselves can fix. But those systems can also create ethical problems if poorly designed or used. Technology-enhanced teaching can expand educational experiences for students, but new directives may alienate professors who feel they are expected to work miracles with minimal incentives or support. Transformation isn’t automatic.

This report explains what decision makers need to know about the trends, innovations, and research that could fundamentally alter teaching and learning in the next decade. It is a road map for leaders trying to figure out how best to prepare their campuses for the technological and pedagogical changes ahead. Each institution is unique, of course. The students they enroll, the programs they offer, and the resources they have at their disposal are key drivers of any conversation around teaching and learning.

But if there’s one universal truth it’s this: The future of learning is not “Trust us.” The future of learning is “Did it work?”

Are college leaders ready to supply the answer?
The origins of the student-success movement date back more than a decade, to when public alarm over rising tuition, low graduation rates, and disparate outcomes by income and race prompted greater scrutiny of higher education. At the top of the agenda were new accountability measures meant to make institutions more transparent — and effective.

Policy makers and families demanded to know: What exactly happens in college? Why do so many students drop out? Is it their fault, or does the institution share responsibility?

Educators, nonprofits, foundations, and businesses joined the conversation. They began experiments to create clearer pathways through college, provide more support for under-represented students, and revamp foundational courses, among other goals. The underlying idea was that colleges could and should do more to help all students flourish, and graduate on time.

In the past decade, the need to identify obstacles and improve results has only become more urgent. Demographic, financial, and technological shifts have made lagging outcomes unacceptable.

The college-going population is growing more diverse, requiring instructors to teach students with a wide array of educational backgrounds and skills. The number of high-school graduates nationally will also soon drop off. Many institutions, particularly in the Northeast and Midwest, where numbers are already falling, need to keep the students they enroll if they want to stay solvent.

Tax-funded support of higher education continues to dwindle, and a majority of states now use some type of performance-based formula to reward — or punish — institutions on measures like graduation rates and job placement.

**TAKEAWAYS**

**Retention** is a financial and social imperative for many institutions.

**Predictive analytics** done well lets colleges identify students’ trouble spots and provide timely interventions to help them succeed.

**Clearer paths** to a degree and more intensive advising can motivate students to stay enrolled and graduate on time.

**Effective course design** — particularly in gateway courses that have high failure rates — is integral to students’ success.

**Open educational resources** reduce the costs of textbooks and other materials to make higher education more affordable.
Many states have also set completion goals for their public colleges and universities. Meanwhile, big data and analytics have come to higher education, enabling colleges to track with greater precision who is struggling, when, and how. Nonprofit organizations and funders like the Bill & Melinda Gates Foundation and the Lumina Foundation have put money and muscle behind evidence-based experiments to improve graduation rates through projects like technology-enabled advising and guided pathways.

Yet despite the time and attention devoted to retention in recent years, colleges still struggle with high dropout rates and inequity of outcomes. The national six-year completion rate for students who started in the fall of 2011 was only 57 percent. The rates for black and Hispanic students were 27 and 18 percentage points lower, respectively, than for white students.

If colleges don’t figure out and implement solutions, they risk losing more students, funding, and credibility. They can no longer point the finger elsewhere and say, “It’s not our fault.”

To be sure, many institutions, notably community colleges, have long served students who are less prepared for and familiar with higher education. And as we will see, today some of those campuses are at the leading edge of interventions like data-driven decision making on teaching and advising.

But student success isn’t a concern for open-access and less-selective institutions only. Highly competitive colleges face significant pressure to diversify their student populations in terms of race, ethnicity, and family income. Some newly recruited students may have graduated from under-resourced high schools or may be first in their family to attend college. Elite campuses are creating programs to provide early academic support and introduce new students to concepts like peer and faculty mentoring. Some have expanded tutoring to try to minimize the stigma of seeking help.

This section will lay out some of the key innovations shaping student success and the promise and challenges they present. The rise of learning analytics can help identify trouble spots, for instance, and intrusive advising can assist students in new and creative ways. Pathways can make clearer how to progress toward a degree, and promoting open

### 1.1: Students Benefit from Charting a Course

They find tools to plan and measure progress toward a degree particularly useful.

<table>
<thead>
<tr>
<th>Tool Description</th>
<th>Very/extremely useful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree-audit tools that show requirements completed</td>
<td>63%</td>
</tr>
<tr>
<td>Degree-planning or mapping tools</td>
<td>61%</td>
</tr>
<tr>
<td>Online self-service tools for student-related business</td>
<td>60%</td>
</tr>
<tr>
<td>Early-alert systems</td>
<td>51%</td>
</tr>
<tr>
<td>Digital tools that keep a record of services used, advice given, or decisions made</td>
<td>43%</td>
</tr>
<tr>
<td>Suggestions about new or different academic resources</td>
<td>43%</td>
</tr>
<tr>
<td>Suggestions for how to improve performance in a course</td>
<td>40%</td>
</tr>
</tbody>
</table>

Source: Educause Center for Analysis and Research, “ECAR Study of Undergraduate Students and Information Technology, 2017.”
educational resources could lower students’ costs. It’s up to college leaders to adopt and adapt such approaches to help students reach their potential.

Predictive Analytics

Big data is everywhere in the student experience. Each answer on an online quiz, every discussion-board post, each grade entered into a learning-management system is a data point. Predictive analytics is the process of mining and analyzing vast quantities of data to find patterns and forecast behaviors.

For a growing number of colleges, the promise of predictive analytics is to close persistent gaps in graduation rates among different student groups, and to move all students more efficiently toward a degree. The higher-ed-tech group Educause has declared student success and data-driven decision-making two of the five most influential trends of 2018.

The use of predictive analytics is not yet widespread on campuses across the country, but the practice is poised to grow significantly. While only 7 percent of institutions have reported deploying institutionwide predictive analytics in student success, according to Educause, more than half of colleges say they are either piloting or expanding use of the technology.

In addition to academic data collected through learning-management and student-information systems, colleges are trying to measure qualities like engagement and resilience. Some track campus activities like trips to the cafeteria, gym, library, or tutoring center through student-ID swipes. Hundreds of data points can reveal signs of risk and allow administrators to intervene.

Did a student complete all of her assignments but still get a poor grade on a test? That might signal a need for one-on-one tutoring. Did a physics major accidentally enroll in a lab for nonmajors? An adviser may send an alert. Does a struggling student rarely visit the library? He may need information about campus resources.

When analytics are deployed effectively, some colleges have seen significant results.

The University of South Florida devised a system that tracks 300 variables, updated nightly, to flag at-risk students long before midterm grades appear. “Suddenly, a whole lot of students started popping up on our list we didn’t have before,” says Paul Dosal, the university’s vice president for student affairs and student success.

The institution has eliminated its graduation gaps by race, ethnicity, and socioeconomic status, while raising completion rates overall. Its efforts earned it the top spot among four-year public institutions that improved their graduation rates between 2011 and 2015, with a 17-percentage-point increase, to nearly 70 percent.

Evangelists envision a day when a network of faculty and staff members are plugged into the same dashboard displaying personalized recommendations based on student activity monitored on campus and online. In that world, a student walking into the library gets a text telling her where the tutoring hub is if she’d like to use it.

If that sounds too tidy — and perhaps a bit creepy — it is. Data-science experts say that despite the hype and potential, predictive analytics is still in its infancy. Barriers to greater use include cost, quality, infrastructure, and campus culture. Mining data and creating effective algorithms is labor-intensive and tough to get right.

You must track the right indicators, clean up the resulting data sets, and develop the proper algorithms to produce actionable information. Then advisers, faculty members, and administrators need to figure out what to do with it, which may require hiring new specialists and retraining others to take a more data-driven approach. Predictive analytics also raises serious questions about data ethics.
Eight percent. That was Lorain County Community College’s completion rate in 2011.

Figuring out how to raise that number by making the path through college clearer and more efficient has been the college’s priority over the last several years. Lorain has revamped nearly every aspect of its academic and advising programs, raising its completion rate to 23 percent and reducing the number of extra credits per degree earned.

“What’s different today,” says Marcia Ballinger, the president, “is that we aren’t asking students if they’re ‘college ready.’ I’m asking our college, ‘Are we student ready?””

Lorain began by joining state and national groups and networks that promote student success, including Achieving the Dream and Completion by Design. And it hired Civitas Learning, an analytics company.

Lorain County is in a region of Ohio with high poverty rates, low education levels, and rampant opioid abuse, notes Ballinger. Making education more accessible is not just good business, she says: “It’s a moral imperative.”

Here are key steps Lorain took to help more students navigate college.

- **Creating meta-majors**
  Where Lorain once had 120 academic options, it now offers nine degree pathways, or exploratory majors, such as education, computer and information technologies, and science and math. After students pick a pathway, they choose a major along the way.

  The move was a heavy lift for the faculty: mapping course requirements for every major, revamping individual courses to fit particular majors, and making sure students wouldn’t take courses that didn’t count. For support, faculty members attended national conferences and worked with coaches from other colleges who had been through a similar process.

- **Streamlining remediation**
  Lorain adopted the Accelerated Learning Program designed by the Community College of Baltimore County, a co-requisite model in which students simultaneously take a remedial and a credit-bearing course in the same subject.

- **Enhancing advising**
  All students who enroll must meet with an assigned adviser before scheduling classes. They can still explore, but also must take a course in their first semester on career options. “Students were swirling with extra credits that were not coherent,” says Ballinger. “We’re trying to get them to a concentration in a field of study.”

- **Deploying data**
  One data-driven move Lorain made, with help from Civitas and its automated course scheduler, was to determine the best class times for students. Offering fewer, targeted courses also saved the college about $600,000.

- **Embedding experiential learning in the curriculum**
  A student in the business pathway, for example, might visit a local small business or a campus-based incubator.
and privacy.

All of this has proved daunting for college leaders. Chief information officers are deeply dissatisfied with their campus analytics infrastructure: Only 16 percent have found their tools very effective, according to a survey by the Campus Computing Project. And there may not be sufficient buy-in at the top: Just 12 percent of college leaders said the use of institutional research and evidence was one of the top five areas of growing importance for presidents, according to the American Council on Education. There is still a great deal of confusion over what predictive analytics is exactly and what it means to apply it.

On many campuses, it remains an aspirational buzzword. “A lot of people say they’re doing it, but they’re not,” says Bridget Burns, executive director of the University Innovation Alliance, a group of 11 large public research universities that shares innovations, including predictive analytics, to promote student success.

Enter a burgeoning market of third-party providers. They include big players like EAB and Civitas Learning, along with start-ups like Heliocampus, a spinoff from the University of Maryland University College’s in-house analytics system. These vendors mine and map data, providing dashboards, training, and guidance as colleges develop interventions for students. Companies like Blackboard that sell learning-management systems are building in analytics as well.

Using a vendor comes with its own set of challenges. Algorithms are typically proprietary, so campus officials can’t necessarily see how data points are weighted or evaluated. That could be a problem if, for example, an algorithm contains an implicit bias that treats data on low-income students differently from that of their peers.

College administrators may have only a minimal role in developing the predictive models in the products they purchase, according to a report last year by New America, a nonpartisan public-policy think tank. Institutions should require vendors to explain what data they are collecting and how they test their algorithms, says Iris Palmer, a senior policy analyst at New America and one of the authors of the report. A pilot project or disparate impact analysis is also advisable, to see how well the algorithms perform. When a student is flagged, a vendor should be able to explain three reasons why, Palmer says. “That’s the kind of transparency colleges should be striving for.”

Whether contracting with a vendor or running their own system, college leaders need to consider several potential pitfalls. Data privacy, security, and equity demand attention. Do students know they’re being tracked? Are appropriate protections in place to keep data safe from hackers? What if a system disproportionately flags minority students? What is the risk that they might be steered into less-rigorous majors?

While most systems measure academic performance, noncognitive factors like resilience and personal issues like homesickness also affect student success. How can predictive analytics take those factors into account? Student-affairs officials often collect engagement and behavioral data, says Amelia Parnell, vice president for research and policy at the student-affairs association Naspa, and that information should be incorporated into student-success efforts, too.

Here are some key factors to making predictive analytics work.

- **Use the right data and algorithms.** This is both the most obvious and the trickiest part of designing a good system. Colleges...
need to track the right metrics, integrate them with other data, and create effective algorithms. That requires the appropriate technology, resources, and talent.

- **Cultivate buy-in from those who work most closely with students.** Advisers often struggle with predictive models because they imply “your instinct about students isn’t good enough anymore,” Palmer says. It doesn’t matter how accurate your system is if people refuse to use it.

- **Pair analytics with appropriate interventions.** Staff members need to understand not only what goes into the algorithms, but what to do with the information they provide. “If a student is predicted as likely to fail, we don’t want to tell that to the student,” says Dosal, of the University of South Florida. Instead, he says, the focus should be on how to improve performance.

- **Invest enough money — and not just upfront.** Predictive analytics is complicated, and if a college doesn’t have the staffing in-house to develop and maintain a system, vendors can be expensive. Software and technical support can cost more than $75,000, plus an annual fee of $30,000 to $125,000, says Sarah Zauner, founder of the Ada Center, which guides colleges on technology decisions. Of course the idea is that the investment will pay off through increased retention, but it doesn’t come for free.

### Intrusive Advising and Guided Pathways

Analyzing data is one thing, effective institutional reforms are another. Even if a campus can identify who is struggling and guide him to tutoring, the next step is to revamp systems based on common trouble spots. Two promising approaches have grown in popularity: intrusive advising and guided pathways. Both require prioritizing students’ needs over faculty and staff members’ interests or preferences.

Intrusive advising denotes a shift from reactive to proactive guidance. Rather than wait for students to come to a writing center or a counselor’s office, advisers reach out. They also make it easier for students to find them. South Florida, for example, put success and wellness coaches in highly visible places, like residence halls and student centers. Some institutions work with private coaching companies that regularly email, text, and call students.

“Colleges are now asking more of their advisers and the advising process — that it be more intrusive, more equitable, and more holistic,” notes a recent report by the Center for Community College Student Engagement at the University of Texas at Austin.

Advisers are expected to help students choose their courses, set academic goals, and review plans, says Evelyn Waiwaiole, executive director of the center. Yet most students who meet with an adviser just talk about registering for classes, the report found. Fewer get information on support services, and fewer still discuss academic or career goals.

While campus officials have seen improvements in recent years, only one in three feels his or her institution has achieved the ideal advising situation, according to a survey of more than 2,000 administrators and advisers by Tyton Partners last year. For many colleges, the problem comes down to staffing, with student-to-adviser ratios sometimes ballooning to 1,200 to 1.

Short of additional hiring, colleges can use technology to extend their advising services. Some tools track progress toward completion, connect students with support services, and provide early warnings of academic trouble. At some institutions, students can use dashboards to stay on track with their coursework and course scheduling and compare their academic progress with their peers’.

Proactive advising doesn’t have to increase costs. It may involve revising a job description, such as requiring advisers to visit classes to promote their services, or asking students to fill out an intake form to learn more about the complexities of their lives, including work and family, says Waiwaiole. If colleges invest more time or money, they may see a payoff in greater retention.

Guided pathways, another emerging innovation in advising, refers to helping students develop an academic plan early on, providing a clear map of the courses they need to take,
and offering continual assistance. Rather than choosing from cafeteria-style offerings in a course catalog, only some of which may count toward their intended major, students get a highly structured course sequence meant to help them complete a degree on time.

For now, guided pathways are more common at community colleges, but elements of the approach are appearing at large, four-year universities as well. As institutions and national groups assess whether pathways move students through more efficiently, some “early momentum measures” are positive, says Thomas R. Bailey, director of the Community College Research Center at Columbia University. Students in the programs are taking more of the kinds of courses they need to earn a specific degree.

Some colleges are also revamping and reorganizing course offerings and grouping them into meta-majors, to help students who have a general idea of what they want to study — say business or health — take the right courses from the start. The Community College of Baltimore County, a leader in this area, made the move after looking at transcripts and finding that nearly a third of students took so many of the wrong courses their first year that they delayed completion by a semester. The college decided to narrow 151 majors to six academic tracks.

While just 7 percent of institutions have a full pathways program, according to an Educause survey, more than half are either piloting or expanding technology to map students’ educational plans. The concept of limiting choice may run counter to some ideas about college, but many students seem to find pathways helpful and motivating.

The movement has been fueled by support from the Gates Foundation, Jobs for the Future, the American Association of Community Colleges, and other groups focused on completion. The California Guided Pathways Initiative dedicated $150 million for community colleges to design academic pathways to help students make better choices and increase their chances of earning a certificate or degree.

As with other campuswide reforms, effective pathways require cross-training and collaboration, so that advisers, administrators, and instructors are working from the same playbook. Faculty buy-in is critical to the programs’ success, says Bailey, because professors must look at the curriculum as a whole, dropping courses that don’t count toward any particular major and revamping others to fit specific pathways.

More broadly, the trends of predictive analytics, intrusive advising, and guided pathways can generate criticism for attempting to engineer the college experience. They certainly represent a different model than many campus leaders and faculty members are used to: a system in which students are free to explore, change their minds, and sometimes fail.

Whether or not a college chooses to adopt pathways, it probably could do a better job of helping students navigate its programs, for their sake and its own. “We’re expected to graduate students on time,” says Dosal, of the University of South Florida. “And the student could be incurring more expenses and more debt if we allow them to wander through the curriculum without any degree in sight.”

### Rethinking the Curriculum

Course design is also vital to student success. All the supports in the world can’t compensate for a poorly structured academic experience.

---

“Colleges are now asking more of their advisers and the advising process — that it be more intrusive, more equitable, and more holistic.”
At the top of the reform agenda are foundational, or gateway, courses. They are required for certain majors, so many students take them, and any given course is likely to have not only a high enrollment, but high rates of failure and withdrawal. If students do poorly in these courses, researchers have found, they are less likely to succeed in college.

Such failure rates used to be considered a sign of rigor. Weed-out courses were, after all, designed to deter students not capable of higher-level academic work. But growing demand for graduates skilled in math and other STEM fields, along with the emergence of teaching techniques that seem to improve student performance, are challenging the status quo.

Reformers are working to prevent course design from tripping students up. Large lectures, for example, are easy places for students to fall behind. Math is often a stumbling block: One recent report found that just half of students pass college algebra. Yet students who want to study business, demand for graduates skilled in math and other STEM fields, along with the emergence of teaching techniques that seem to improve student performance, are challenging the status quo.

When it comes to predictive analytics, Georgia State University is arguably the leader of the pack. An army of advisors there tracks more than 800 risk factors daily, and innovations include in-class tutors, restructured gateway courses, and freshman learning communities. The public research university raised its six-year graduation rate from 32 percent in 2003 to more than 54 percent in 2017.

That’s all the more remarkable considering that many of its students come from groups with higher dropout rates nationally. Georgia State’s population is 60 percent nonwhite and one-third first generation; 58 percent of students are on Pell Grants. And they all now graduate at the same rate as everyone else.

Leading the charge there is Timothy Renick, senior vice president for student success, and an evangelist for “tech-enabled high touch.” Here are some of his insights, as told to The Chronicle.

• “Generic” support isn’t enough. Georgia State found that a student’s grade in an introductory course in his or her major is one of the main indicators of future academic performance. Yet tutoring used to be “fairly generic,” says Renick. The campus had a writing center, a math lab, and a language lab. What if a student needed help after failing his first accounting quiz? “It wasn’t enough to say, ‘Go to the math lab,’” Renick says. “That wasn’t going to help with specific course content.”

• You don’t need a ton of money to fix that. Georgia State now pays undergraduates — often work-study students — who have done well in particular courses to sit in on more than 1,000 course sections and offer weekly tutoring sessions. “We might have liked to hire all professional staff to do that work,” says Renick, “but we didn’t have the resources to do that at scale.”
economics, or STEM subjects need to learn foundational math.

Some colleges are replacing traditional math courses with ones that focus on practical skills, like quantitative reasoning, or are tied to majors, like calculus for life sciences. Others are flipping classrooms to introduce students to new material through online videos and exercises and reserving class time to go over challenging concepts (See Section 2).

Another approach is to build supports into the course itself. Georgia State University hires students who have successfully completed certain foundational courses to come back the following semester as tutors.

Remedial, or developmental, courses demand particular attention at community colleges. Nearly two-thirds of entering students place into at least one course in math or English, and only 20 percent end up passing the associated college-level course, according to the Community College Research Center. A disproportionate number of those enrolled in remedial education are

- **Change how you teach introductory courses.** Georgia State “flipped” more than 8,000 seats, mostly in introductory courses, using adaptive-learning technology. Another 12,000 to 15,000 seats will go that way over the next three years. That means traditional lecture sections have been replaced with students reviewing new material on their own and applying the concepts, with personalized attention, in class.

  This strategy has proved successful in getting students through critical gateway courses into their chosen majors. As the number of students who declare a major in STEM has held steady, the number who complete those majors has doubled.

- **Remove unintended academic barriers.** Using predictive analytics, Georgia State discovered unintended consequences of some academic departments’ policies. The university’s business major, for example, used to require a GPA of at least 2.8 to take upper-level courses. It turned out that more than 1,000 would-be majors were taking courses in other departments to try to hit that mark. Now students must perform well in key lower-level courses to advance.

  “Instead of having 1,000 students spinning their wheels thinking they’re going to graduate in business but never getting that right GPA,” says Renick, “we’re making that determination up front.” Underperforming students can pick another major and still graduate on time.

- **Make pathways clearer.** Five years ago, the average student at Georgia State was going through 2.6 majors before graduating. “That’s a deadly recipe for low-income students,” Renick says. “They can’t afford to switch majors two or three times and waste credit hours and create added debt loads.”

  The university was already putting freshmen in groups of 25 for core classes, so it began organizing learning communities around meta-majors like education, business, and STEM, and adding elements like departmental open houses and alumni career talks to help students make decisions earlier. Since then, the university has seen a 32 percent drop in the number of students who change their major in their sophomore year or later. The average time to a bachelor’s degree is now half a semester shorter.

- **Invest in professional advisers.** When Georgia State introduced predictive analytics in 2012, it hired a slew of advisers — often entry-level staff members, sometimes recent college graduates — to respond quickly to hundreds of alerts each week. That investment has more than paid for itself through increased retention. Advisers held about 52,000 one-on-one meetings with students last year, Renick estimates. “We get a lot of attention about the fancy tech,” he says, “but what we’re really doing is delivering common sense at scale.”

- **Information is power.** Higher education often blames poor academic performance on inadequate preparation in K-12 schools. “What we found, and it’s a hard truth, is that a lot of the fault is our own,” Renick says. “We overwhelm students with choices. We don’t provide information they need in a timely fashion.”

  Georgia State isn’t hand-holding, he says. "We’re tipping students off earlier on that there might be a problem and giving them a fighting chance to correct it."
first-generation and low-income students, which suggests that eliminating achievement gaps may start here.

Some colleges are moving students whose placement tests show a need for remediation straight into credit-bearing courses, with supports such as peer mentoring, mandatory tutoring, or learning communities. The California State University system plans to eliminate all noncredit remedial courses this fall. Instead, students will enroll in college-level courses with supplemental tutoring, among other supports.

Colleges are also shifting to collective course design, in which faculty members together with specialists in instructional design and learning science craft the curriculum. Team-based design is a “mega-trend” in higher education, a practice that will move from the vanguard to the center in a matter of years, says Phil Hill, a consultant and blogger who focuses on technology’s impact on teaching and learning.

The challenges of curricular reforms include providing adequate faculty support to engage in this work through, for example, technical assistance and stipends (See Section 2). Colleges must remove barriers, says Hill. “Faculty by and large want their students to do better, so don’t penalize them because this takes extra time.”

**Outside the Classroom**

Learning goes beyond class: Real-world engagement can help promote student success. Research shows that activities such as service learning, study abroad, internships, and collaborating on projects with a professor deepen learning and enhance intellectual development. Yet these high-impact practices are not offered in any systematic way on most campuses, according to the Association of American Colleges & Universities.

The challenge for college leaders is to ensure all students have access to such an experience. That is critical because first-generation and minority students are far less likely to participate, as cost and time constraints can present significant barriers.

Here are some approaches to providing all students with a high-impact learning opportunity.

- **Make it mandatory.** Elon University and the University of Georgia, among other institutions, require all undergraduates to participate in at least one experiential-learning activity before graduating.

- **Ease the financial burden.** Furman University and California State University at Fullerton have added financial and other supports to help more students participate in study abroad and other potentially costly experiences.

- **Tailor everyday experiences.** An athletics team might discuss coaching philosophies; a work-study job may connect to a student’s major.

- **Build it into the curriculum.** A community-service project can be incorporated into credit-bearing coursework.

At Ball State University, students collaborate with classmates and a faculty mentor on an interdisciplinary project to solve a problem or create a product with a community partner. In semester-long, credit-bearing projects, students have developed marketing plans and conducted facilities audits for local nonprofits, guided elementary schoolers on writing and science assignments, run laboratory experiments for local health-care providers, and built community gardens. These immersive learning opportunities, widely available across disciplines, have become integral to the university’s identity.

Scaling up high-impact practices requires creative leadership and strong administrative support, including for faculty members willing to take risks. But it can provide a significant payoff in student en-

---

As part of an immersive-learning project, students helped design a strategic marketing plan for an orchid greenhouse at Ball State University.
gagement — and an answer to critics who say higher education doesn’t effectively prepare students for the workplace.

Immersive learning accelerates students’ career development, says Jennifer Blackmer, associate provost for entrepreneurial learning at Ball State. “It’s what they can talk about in job interviews. What they can take with them when they graduate. It’s a bridge between sitting in a classroom and holding a job.”

Reducing Textbook Costs

The cost of textbooks can be a huge obstacle to student success. A survey by the consumer-advocacy group U.S. PIRG found that 65 percent of students had not bought a textbook because of its high price, and 50 percent had decided how many and which classes to take in part because of textbook costs. Yet 94 percent said they didn’t do as well without the textbook.

Enter open educational resources (OER). Once on the fringes of higher education, the movement, which promotes openly licensed materials for students and professors to use free of charge, is catching on. New York State has provided $8 million for public colleges to adopt OER. The California Legislature has dedicated $5 million to create zero-textbook-cost degrees at the state’s community colleges. And in its recent budget bill, Congress set aside $5 million for the creation and use of OER textbooks.

OER is shaking up the textbook industry and opening the door to new players. Lumen Learning, an open-access company, and OpenStax, a nonprofit publisher based at Rice University, are creating products and support systems to bring open courseware to scale, primarily in large introductory courses. Traditional publishers such as Macmillan Learning, along with newer companies like Top Hat and VitalSource, are adding openly licensed materials to their offerings, and lowering their prices in the process.

A University of Missouri system program to lower costs through OER led to a partnership with McGraw-Hill Education to reduce the cost of e-books by nearly 40 percent. Another publisher,
Cengage, is incorporating OER into its materials while also offering a new subscription model — similar to the Netflix streaming service — that gives students access to its library of digital textbooks for a flat fee.

These innovations are likely to result in lower textbook costs for students, but the OER trend is hardly mainstream. Last year, not even one in 10 faculty members had adopted open-licensed textbooks, according to the Babson Survey Research Group. Take-up in large introductory courses, though, is higher: Nearly 17 percent of professors used OpenStax textbooks in those courses. Over all, about half of faculty members surveyed said that there are not enough resources for their subject and that it is difficult to find what they need. Still, more than 70 percent of chief academic officers expect OER to be a major source of curricular content in five years, according to the Association of Chief Academic Officers.

College leaders interested in open materials should encourage but not mandate the use of OER, advocates say. Faculty grants, for example, can help professors develop courseware based on available materials. Involving instructional designers, librarians, and campus bookstore operators can also advance the process. “One of the things that makes OER successful,” says Nicole Finkbeiner, associate director of institutional relations for OpenStax, “is when you have all of the entities on campus working together.”

Promoting both access and success — helping students not just to but through college — means analyzing data to find trouble spots, revamping general education, and establishing clearer pathways to graduation, among other innovations. None of that matters, though, if students aren’t actually learning. What happens in class and efforts to improve that experience will shape the debate over the value of college.

In the next section, we will explore innovations in teaching, like flipped classrooms and active learning, and describe how to keep institutions current in the digital era.

### 1.3: FEW ASSIGN OPEN TEXTBOOKS
About one in 10 professors reported using an open-licensed textbook last academic year.

### HERE’S WHAT’S HOLDING THEM BACK
They don’t feel they can rely on the material.

<table>
<thead>
<tr>
<th>Reason</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficult to find what I need</td>
<td>50%</td>
</tr>
<tr>
<td>Lack of resources for my subject</td>
<td>47%</td>
</tr>
<tr>
<td>Concern about updates</td>
<td>29%</td>
</tr>
<tr>
<td>Not high quality</td>
<td>28%</td>
</tr>
<tr>
<td>Questions on permission to use or change</td>
<td>23%</td>
</tr>
<tr>
<td>Lack of track record</td>
<td>20%</td>
</tr>
<tr>
<td>No good print options</td>
<td>20%</td>
</tr>
<tr>
<td>Lack of associated materials</td>
<td>18%</td>
</tr>
<tr>
<td>Not used by other faculty</td>
<td>16%</td>
</tr>
<tr>
<td>Not current, up-to-date</td>
<td>16%</td>
</tr>
</tbody>
</table>

Students work at their own pace with adaptive courseware at Austin Community College.
The need to improve undergraduate teaching is widely recognized. But the structures of college often stand in the way, from conventional classroom architecture to cultural norms that value lecturing over more active forms of learning.

A number of innovations are starting to change the landscape. New technologies, of course, are some of the main drivers. Students use digital textbooks and submit assignments online. Professors record lectures and post coursework in learning-management systems. Teaching tools like clickers and interactive apps are staples in many classes.

Technology has been part of the educational experience of many of today’s undergraduates since elementary school. Raised in an era of on-demand and personalized tech, members of Generation Z expect access to coursework and connections with classmates and instructors whenever and wherever. A growing number of students are enrolling in both online and face-to-face courses, which puts pressure on institutions to encourage more faculty members to teach online. Gen Z, prone to digital distraction, is also increasingly impatient with long readings and lectures, fueling debate over the role of laptops and smartphones in the classroom.

Surveys show that professors and students alike prefer courses that blend face-to-face teaching with online work. More than 70 percent of faculty members prefer this so-called hybrid model, according to a survey by the Educause Center for Analysis and Research, an arm of the higher-education-technology consortium.

The phenomenon of massive open online courses, or MOOCs, has made academics more familiar with the idea of incorporating video and other technology

**TAKEAWAYS**

**New technology and pedagogy** show signs of improving students’ learning and performance.

**Active learning** spurs students to grapple with subject matter in class and stay engaged through group discussion and projects.

**Some technology-driven teaching tools** like adaptive courseware have promise, but research on outcomes is lagging.

**Effective teaching** requires investments in professional development, yet many faculty members feel their colleges do not support experimentation.

**Academic leaders** should promote innovation but not foist new tools and techniques on the faculty.
into their teaching. That presents both opportunities and challenges for administrators, as they consider the infrastructure, personnel, and skills needed to support such experimentation.

Faculty members are often frustrated in their efforts to do more with technology, surveys show: Two big barriers are a lack of time and limited technical and instructional support. Fewer than half of faculty members who designed or revised an online or blended course received professional development, found a survey last year by Gallup and Inside Higher Ed. Add to that the fact that the majority of faculty members are now adjuncts, posing greater challenges to providing such support.

When it comes to academic technology, there’s often a significant disconnect between institutional strategy and action. Only one in four administrators who consider support for faculty development critical to digital learning believes their campus is doing it effectively, according to a report by Tyton Partners and the Babson Survey Research Group. And the buzz surrounding ed-tech innovations makes it difficult for both faculty members and administrators to sort hype from reality.

This section will explain what academic leaders need to know about key innovations shaping the future of teaching and learning. Those include the rise of flipped classrooms, the evolution of adaptive learning, and the growing popularity of active classrooms, plus the necessary equipment and capacity to pull them off. It will also explain the state of research on teaching and learning and examine the barriers to innovation. Finally, this section and the next, Managing Change, will detail the decisions academic leaders must make to transform the educational experience at their institutions.

**Active Learning and Flipped Classrooms**

College teaching has followed the same format for generations. A professor stands at the front of the room and lectures while students sit quietly taking notes. Often a high-stakes final exam determines the bulk of their grade. All of that is especially true in the large introductory courses that many students take — and struggle with — early in their college careers.

It’s how our parents learned, how we learned, and, for the most part, how students are still learning. In recent years, though, more educators have been asking, Why? Why do we think lecturing to students equals learning? Why do we think exams are the most effective way to test understanding? Why do we need traditional classrooms at all?

In the recent book *The New Education: How to Revolutionize the University to Prepare Students for a World in Flux*, Cathy N. Davidson explains that the roots of modern higher education lie in the late 19th and early 20th century, when the American economy required specialized, credentialed workers to support the growth of manufacturing and the acceleration of mass production.

College curricula and teaching methods have not changed much, but society has. The internet has put information at our fingertips, reducing the need for rote memorization, while our rapidly evolving economy requires workers who are adaptable, can analyze a constant flow of data, solve problems quickly, and act independently.

“Students need new ways of integrating knowledge, including through reflection on why and what they are learning,” writes Davidson, who directs the Futures Initiative at the City University of New York. “They don’t need more ‘teaching to the test.’ They need to be offered challenges that promote their suc-

**“The burden is not to be entertaining, but how do I get students to realize what they don’t know and construct their own knowledge?”**
cess after graduation, when all the educational testing has stopped. This is an engaged form of student-centered pedagogy known as ‘active learning.’"

Active learning requires students to grapple with subject matter rather than passively absorb information. A professor may still give a short lecture, but act more as a coach or a guide as students put that knowledge to use. A growing number of institutions are experimenting with this style of teaching, which emphasizes class-based exercises, discussion, and collaboration.

Some universities are renovating classrooms to encourage this type of learning. They are ripping out rows of seats and replacing them with flexible workspaces, including tables where students can work together. Instead of a single whiteboard at the front of the class, writing surfaces are spread throughout the room to allow students to puzzle through problems. Swivel chairs can make lecture halls more interactive. Research has shown that classroom space affects the behavior of both instructors and students. In an active-learning environment, professors lecture less and walk around more. Students engage more with one another and the instructor.

The higher-ed-tech group Educause has declared active-learning classrooms a top strategic technology. And several institutions are making bold bets, designing new buildings around the concept of active learning. The University of Maryland at College Park invested $120 million in a learning and teaching center, where a variety of classrooms let professors experiment with their teaching. Colleges without deep pockets are experimenting with simple but significant changes, such as adding more round tables to classrooms.

The University of Minnesota-Twin Cities was an early adopter of active learning. When the flagship campus was designing a new science building about a decade ago, it looked to active spaces at some of the originators, North Carolina State University and the Massachusetts Institute of Technology. Today, says Jeremy Todd, director of the Office of Classroom Management at Minnesota, the 16 active-learning classrooms in that science building are some of the most sought after on campus.

Here are a few of Todd’s suggestions for college leaders interested in developing active-learning classrooms.

- **Conduct site visits** to see firsthand what might work on your campus.
- **Pilot a few designs** and observe how students and instructors use the space.
- **Keep technology simple** because faculty and students don’t have a lot of time to learn new things.
- **Collaborate with educational researchers** to measure the impact on learning.

Faculty members may be skeptical. Sehoya Cotner, an associate professor of biology at Minnesota, certainly was: She took pride in her ability to engage students with her lectures. But when teaching a large course in an active-learning classroom, she kept her lectures short and gave students projects that...
put new concepts into action, like simulating cell division with pipe cleaners and beads. “The burden is not to be entertaining,” she says, “but how do I get students to realize what they don’t know and construct their own knowledge?”

Students in Cotner’s active classroom outperformed those she taught in a traditional format, with the greatest gains made by women and minority students. Her experience is supported by research: A high-profile meta-study of more than 200 studies of active learning found that students seem to perform better in such an environment. They score higher on exams and are less likely to fail compared with peers taught in the traditional lecture format.

The concept of flipped classrooms has become part of many active-learning classes. That means students review new material before class, often through structured activities like watching a video or doing a problem set. With class time freed up for more interaction, professors guide students to apply the new material, often in groups.

Flipped learning was born out of a common challenge: reaching students of different abilities in class. To make the approach effective, class time must be highly organized, with the instructor keeping students engaged and active, says Robert Talbert, an associate professor of math at Grand Valley State University and author of *Flipped Learning: A Guide for Higher-Education Faculty*. Poorly designed or executed flipped classes risk becoming study halls.

For now, the strategy is most common in disciplines that have traditionally relied heavily on the lecture: physics, math, and other STEM fields. Research on it is doubling every 18 months, says Talbert, but the practice is still at the margins, which he attributes to colleges’ not valuing innovative teaching. (Grand Valley, for one, includes effective teaching in its promotion and tenure guidelines.) He and other advocates are convinced that flipped learning represents the future of higher education.

**AI, Adaptive Learning, and Tech Tools**

Artificial intelligence and machine learning are coming into the classroom in a variety of ways, notably in the development of adaptive courseware. That’s part of a broader...
effort to personalize educational materials so students can learn at the pace best for them. To that end, adaptive courseware is primarily being used in large, general-education classes where many students may otherwise fall behind.

Digital, interactive course materials are driven by data and analytics, designed to deliver content and instructional support in response to how a student is learning. If she demonstrates mastery of a concept, she can move on to the next lesson. If not, she is given additional instruction, review, and evaluation.

Adaptive courseware has a new home at Austin Community College, which took over an abandoned mall and turned it into a 32,000-square-foot learning laboratory with 600 computer stations on its Highlands campus. Students in remedial and college-level subjects attend class in the ACCelerator, with individual plans based on their starting points, and goals worked out with instructors in advance. “Students like the anonymity of being surrounded by hundreds of students,” says Charles Cook, the provost. “They’re not singled out as remedial.”

Anyone who needs help places a cup on top of a light. When an instructor notices similar questions from several students, she pulls them into one of the breakout rooms that surround the space. Initial data show that students who visit the learning lab at least once have a 6 percent higher retention rate, says Cook, who plans to scale up the use of adaptive courseware.

Colleges interested in adaptive learning can buy fully designed courseware, add
Arizona State University has a reputation for innovation. Its president, Michael M. Crow, is an outspoken advocate for the so-called new American university, one that emphasizes access over selectivity and prepares students to work in a complex, fast-changing world.

Arizona State likes to experiment and is often seen as a laboratory for what’s possible in higher education. Its deal with Starbucks in 2014, for example, discounted tuition for employees to take courses online.

Here are three areas where the university is investing.

**Adaptive and Active Learning**

Several large public universities are experimenting with adaptive learning, in which interactive digital courseware adjusts lessons based on how well a student understands the material. Arizona State plans to scale up to a full degree in that format.

After introducing adaptive courseware in developmental math in 2011, the university embedded adaptive learning into introductory courses in biology, chemistry, physics, history, psychology, and economics. Part of that transformation, says Dale Johnson, the adaptive program manager, was a shift toward active learning, or engaging students more deeply in class through problem-solving and group work. Withdrawal rates in revamped courses have dropped, a good sign for the university as it works to increase retention.

To support course development and redesign, faculty members get supplemental pay as well as training and technical support. Their professional development includes a starter kit, or series of activities, to create active-learning classrooms.

The next goal is an adaptive degree in biology. That will require an entire library of courses built from the ground up. “It’s going to be very expensive,” says Johnson, “very time consuming, and — we hope — very successful.”

**Gamification of Courses**

Many students would rather sit down in front of a PlayStation than a textbook. So Arizona State faculty members asked: Why can’t class be more like a video game? Two courses, HabWorlds and BioBeyond, promise just that.

HabWorlds, short for habitable worlds, introduces students to astronomy, biology, chemistry, geology, and physics as they search for life beyond earth. They find and describe hypothetical habitable planets through interactive tutorials, then test ideas in a simulator, which tells them if they’re right. After watching a short video on types of stars, for example, students are asked to hypothesize which ones live the longest. Then they run a test to see.

Arizona State’s Center for Education Through eXploration develops coursework that builds on the ideas behind HabWorlds, such as a series of open science lessons for students of all ages called Infiniscope. The center also leads the Inspark Science Network, which shares information about adaptive and innovative science education.

**MOOCs Toward a Degree**

While massive open online courses, or MOOCs, are no longer hailed as the great disruptor of higher education, Arizona State is using them to attract more students. The university created its Global Freshman Academy in 2015 so that people anywhere in the world could take a sequence of MOOCs designed by Arizona State faculty members that count toward the first year of a degree.

So far more than 400,000 people have signed up for one of 14 courses. Only 15 percent of them have completed a course for credit, however, and the number who have enrolled in a degree program is very low. The plan now is to get more students enrolled through to completion.
their own material to a vendor’s platform, or combine the two. Companies such as Acrobatiq, Realizeit, and Smart Sparrow are forging ahead with adaptive products and platforms in fields such as math, biology, and history. Traditional textbook publishers are also major players in adaptive courseware, increasingly building AI into their materials. Pearson, an educational products and services company, calls its intelligent tutoring system Watson, while McGraw-Hill Education offers Assessment and Learning Knowledge Spaces, or ALEKS.

For now, adaptive courseware is primarily used at large institutions, including Arizona State and Colorado Technical Universities and the University of Central Florida. In the spring 2018 semester, Central Florida was offering 20 adaptive courses, enrolling 4,000 students.

The Bill & Melinda Gates Foundation has invested about $20 million in the development and testing of adaptive-learning software. Gates also supports a project of the Association of Public and Land-Grant Universities to scale up adaptive courseware at eight institutions, with the goal of reaching at least 85,000 students.

Adaptive learning is an emerging technology, not a panacea. The former head of Knewton, an adaptive-learning company, infamously compared his products with “a robot tutor in the sky that can semi-read your mind and figure out what your strengths and weaknesses are, down to the percentile.” In truth, adaptive-learning products are far from that, at this stage at least.

Also, as with flipped and active learning, one of the challenges of adaptive courseware is that it demands a change in teaching. To pull that off requires technical and pedagogical support, and an empirical base of evidence to persuade faculty members to make the change.

Beyond adaptive courseware, colleges are experimenting with other forms of artificial intelligence and technology-driven teaching tools. Here are some that show promise.

- **Immersive technology**
  This includes 360-degree video, virtual-reality headsets, and augmented reality (think Google Glass, but better).

- **Gaming**
  Some faculty members are building courseware that functions like a video game to engage students. Arizona State offers a course called HabWorlds in which students find and describe hypothetical habitable planets through interactive tutorials, testing ideas in a simulator. The course, which received support from NASA and the National Science Foundation, is being adopted on other campuses.

- **Mobile learning**
  Nearly two-thirds of college students use their smartphones to study, and the global market for mobile learning is projected to grow by 36 percent annually. Colleges are experimenting with ways to engage students in and outside of class through their phones. Purdue University created an app called Hotseat that allows students to ask questions, take polls, and have backchannel discussions during class.

“**In hard sciences, you can control all the variables in the lab. It doesn't work that way in the classroom.**”

- **Next-generation LMS**
  Learning-management systems are a fixture in higher education, but they make it hard to integrate educational tools, analyze data, and add courseware
from multiple sources. In the next few years, these systems may become more adaptable to different forms of teaching and learning.

• **MOOCs**

Designed to provide education to the masses, MOOCs are now being used in new ways, on and off campus. Duke University, for example, is piloting a partnership to offer computer science to low-income high schoolers in Tennessee. The university has also opened its catalog of MOOCs to its own students and is creating short MOOCs, like data science, as bridges from college to career.

• **Measures of noncognitive skills**

Personalized learning and predictive analytics are largely focused on how students perform in class. Qualities like motivation and self-discipline are influential, yet difficult to measure. Researchers are trying to capture those attributes — and design interventions to strengthen them. McGraw-Hill is adding prompts (“nudge analytics”) to its courseware for students who show patterns of procrastination, says Alfred Essa, vice president for analytics and R&D. The goal: to create better study habits.

• **Robot tutors**

The Georgia Institute of Technology made national news for introducing Jill Watson, an AI-driven teaching assistant, to students in an online course about artificial intelligence. A research team spent more than 1,500 hours training Jill on a data set of 40,000 questions asked in previous classes, so the robot could answer students’ questions like any other TA.

Ashok K. Goel, the professor at Georgia Tech who thought up Jill Watson, continues to pilot more AI-based innovations, such as nano-tutors within a course to help students master concepts.

AI-driven systems have the potential to revolutionize education, from K-12 through college, Goel believes, by freeing instructors from routine tasks to focus on more intellec-
tually challenging work with students. “Let’s amplify the reach of the teachers we already have so we can reach more and more humans,” he says. “And hopefully everyone has access to education a generation from now.”

Measuring What Works

Educators and researchers struggle to evaluate new teaching technologies. Measuring learning is hard enough, and identi-

Teaching Faculty to Teach Online

At the University of Central Florida, any faculty members who want to create an online course must take an intensive, non-credit course of their own, with seminars, labs, one-on-one consultations, and peer collaboration.

About 100 faculty members take the 80-hour, mostly online course each year, says Kelvin Thompson, executive director of the university’s Center for Distributed Learning. By now nearly 70 percent of the faculty has received some training on digital teaching, not surprising at an institution where many courses are taught online.

Here are some of Central Florida’s insights into what works in coaching faculty members to teach online or hybrid courses (an increasingly popular blend of online and face-to-face instruction).

- **Help faculty members learn from one another.** Each course brings together professors from different disciplines to discuss their respective techniques. Each participant gives a final presentation, which could include a discussion of a course-design challenge or ideas for interacting with students online.

- **Think like a student.** Central Florida structures the faculty course mostly online so participants experience that form of instruction for themselves.

- **Instructors must try out whichever tools and techniques they want to incorporate into their classes.**

- **Connect the pedagogical and the technical.** The course is equal parts instructional design, proven practices, and experience, Thompson says. As faculty members learn about the science of online teaching, they are also doing the nuts-and-bolts work of building a course module.

- **Give it time.** Even with 80 hours of work, faculty members walk away with just the shell of a course and one week of material. They continue to collaborate with an instructional designer to flesh out the rest. The goal is to give instructors time to reflect and experiment.

- **Compensate your faculty.** Participants can request a reduced course load or a $2,500 stipend. Most choose the latter, but either way, it’s important to recognize how much work goes into professional development and to compensate faculty members accordingly.

- **Overwhelmed? Start by hiring an instructional designer.** About 75 people work in Central Florida’s learning center. Few campuses have that kind of infrastructure, but they may consider hiring an instructional designer, someone who understands design, pedagogy, logistics, and technology, Thompson says. “That person is worth their weight in gold, and you can build around it.”

Faculty members take a course on designing online courses.
fying which tools are most effective is even more of a challenge. Much of the research to date consists of small studies whose outcomes are specific to one campus, class, instructor, and group of students. That makes it tricky to draw broad conclusions about what works.

“In hard science, you can control all the variables in the lab. It doesn’t work that way in a classroom,” says Patsy Moskal, associate director of the Research Initiative for Teaching Effectiveness at the University of Central Florida. “A lot of it is sensitive to course design.”

One recent study by the research institute SRI International illustrates that point. The Gates Foundation gave money to 14 colleges to experiment with adaptive courseware, and SRI tried to measure the impact. The study found no substantial difference in grades and course completion between students who used the adaptive courseware and those in traditional classes. Yet the authors cautioned that a lot of the data couldn’t be analyzed.

Meanwhile, Arizona State and Central Florida, steadily increasing their use of adaptive courseware, have seen positive results. That suggests that outcomes may depend on how an institution designs and implements the courseware, including how well it trains instructors to use it. In fact, the SRI study found that adaptive technology was more effective when the whole course was redesigned around it.

Most colleges cannot or do not dedicate the level of resources Arizona State and Central Florida do to help faculty members test mobile technology, adaptive learning, and flipped classrooms, among other technologies. More commonly, professors rely on word of mouth to pick ed-tech tools.

Some recent efforts are trying to bring more rigor to the process. This year Phil Hill and Michael Feldstein, ed-tech consultants and publishers of the e-Literate blog, launched the Empirical Educator Project, a collaboration among vendors, educators, and researchers to design and run educational experiments on student success. The nonprofit Jefferson Education Exchange also began in 2018, to support the development of research protocols to track educators’ experiences with different ed-tech tools. The goal is to generate insights to guide broader decision making at the institution and state level on technology usage. A number of universities and associations, such as the Online Learning Consortium, are also compiling and disseminating research on education technology.

Given the complex challenges education technology is designed to solve, and the limited research on what works, technology experts have some advice for academic leaders.

- **Think of technology as a tool, not a cure.** “We tend to chase the shiny object,” says Moskal, of Central Florida. “Don’t let the technology drive the education, but let the education drive the technology.”

- **Don’t make top-down decisions.** Faculty need to be involved in the process of trying new educational technologies, says Moskal. “They can make or break any initiative.”

- **Technology and training go hand in hand.** Central Florida requires that all faculty members who want to teach online go through an intensive design class (See page 33). Not all colleges may need or want to do that, but a lack of professional development or technical support are two main reasons ed tech falls short of its promise.

### Pedagogical Reform

Improving learning is a puzzle that technology alone cannot solve.

The groundbreaking study and book *Academically Adrift: Limited Learning on College Campuses*, by Richard Arum and Josipa Roksa, sent shock waves across the country in 2011 with its unsparing critique of undergraduate education. Using data from the Collegiate Learning Assessment and other measures, the authors found that 45 percent of students showed no significant improvement in critical thinking, complex reasoning, or writing during their first two years of college. The book has fueled public concern that colleges are failing their students and introspection in the academy about the quality of undergraduate teaching.
“Widespread inattention to teaching quality in the preparation, selection, and assessment of faculty is a major obstacle to improved undergraduate student learning,” concluded the Commission on the Future of Undergraduate Education formed by the American Academy of Arts and Sciences.

Historically, doctoral education has done little to prepare aspiring professors for the classroom. Only one in five faculty members received any meaningful pedagogical training in graduate school, according to a Twitter poll by one academic last fall. Yet more than 70 percent of faculty positions now are off the tenure track, meaning that a majority are focused not on research, but teaching.

“Most of us just don’t have any background or training in teaching,” says James M. Lang, director of the Center for Teaching Excellence at Assumption College and a Chronicle columnist.

If undergraduate education is to improve, academic leaders must pay more attention to the quality of teaching on their campuses. To some degree, that is already happening. More doctoral programs are training students to become not just top-notch researchers, but also effective teachers. And a majority of four-year colleges now have teaching and learning.

Courses should emphasize intellectual growth, not tests.

Too many introductory courses are designed to weed out students, when they could instead encourage what the psychologist Carol Dweck called a growth mind-set — the theory that intelligence is not fixed — which might motivate them to apply themselves.

More professors should replace high-stakes midterms and finals with frequent, more minor tests that students (especially freshmen) can repeat to gain confidence academically, Mehaffy says. The message is: No, you’re not bad at math. You’ll just have to work at it.

A curriculum should have meaning for students.

Most students say they enroll in college because they want to get a good job. So colleges need to be explicit about how their courses, particularly in general education, are relevant to students’ future. Instead, says Mehaffy, we tell them to “pick two from column A and two from column B.”

Meta-majors tend to align with career paths, and interdisciplinary coursework engages students. Those are two components he thinks help build a meaningful curriculum.

Core courses should follow national models.

Higher education takes a “cottage-industry model of course design,” Mehaffy says. As a result, core courses — the ones that make up the bulk of the general-education curriculum — are inconsistent, including in their use of instructional design, technology, and assessment.

A national collaboration among colleges could create a set of core courses for virtually any campus. “We’re going to have to get to a point,” he says, “where despite the cultural value of, ‘I only teach courses I’ve designed,’ we have high-quality courses that have been designed with literally millions of dollars put into them, created with a suite of practitioners.”
centers to help faculty members refine their techniques.

Some institutions are trying to spark conversations about teaching within and across academic departments. Two big names — Harvard University and the University of Michigan — have invested $40 million and $25 million respectively to improve teaching. The money has gone toward scaling up innovations, as well as generating dialogue among faculty. Faculty members who spend at least five hours a week trying to improve their teaching, studies have found, rely less on lectures and more on small-group activities.

To refine scientific teaching skills, the biology faculty at San Francisco State University began a collaboration five years ago that included 100 hours of training, workshops, and research. The results were overwhelmingly positive: Faculty members reported extensive changes in teaching practices and stronger relationships with colleagues.

Several high-profile learning scientists have sought in recent years to share their research with a wide audience, releasing a slew of books with catchy titles: Make It Stick: The Science of Successful Learning; How We Learn: The Surprising Truth About When, Where and Why It Happens; Why Don’t Students Like School? A Cognitive Scientist Answers Questions About How the Mind Works and What It Means for the Classroom.

Many of the ideas behind those books animate teaching and learning centers on various campuses, notes Lang, author of Small Teachings: Everyday Lessons from the Science of Learning. And they do not require wholesale changes in the classroom.

One modification might be the use of frequent, low-stakes quizzes so students are regularly prompted to remember what they’ve learned. That helps embed information in their long-term memory, research shows. Another effective teaching practice is asking students to make predictions based on preliminary information. That helps activate prior knowledge and connect it to new material, which can stimulate students to think deeply.

Despite new attention to and research on teaching practices, good teaching is still widely seen as an art, not a science. Professors tend to default to what is comfortable and familiar: the lecture model.

Lauren Herckis, an anthropologist at Carnegie Mellon University, spent months following faculty members who were asked to try new evidence-based teaching tools and practices. It turned out that they relied on experience and instinct more than on evidence, she says. Professors value their independence and fear losing autonomy by adopting someone else’s educational materials. Any campus conversation on updating teaching styles or incorporating technology into the classroom should acknowledge those doubts.

Another barrier to reform is that many teaching and learning centers lack the capacity to reach a large share of faculty members. Those most resistant to change are probably the least likely to show up. And there are few incentives for innovation.

Academic leaders can promote experimentation and improvement in teaching in several ways.

- **Enable work on teaching and learning.** That may mean amplifying the efforts of a teaching and learning center, hiring more specialists in instructional design, or underwriting more professional-development workshops.

- **Support experimentation.** Give faculty members a course release or extra pay if they are redesigning their courses to add technology or create a hybrid or fully online model. Provide technical assistance.

- **Reward innovation.** Review tenure and promotion guidelines to ensure that faculty members are not penalized for experimenting with new forms of teaching, even if students are initially critical in course evaluations. “The vast majority of professors I talk to are fearful,” says Talbert, of Grand Valley State University. “They really feel like students are going to rebel, and they’re going to lose their jobs.”

- **Prioritize pedagogy in doctoral programs.** A program at the University of Washington allows doctoral students to shadow Seattle-area community-college
professors as they teach and advise students.

- **Encourage campuswide discussions on the use of technology in the classroom.** This hot-button issue brings out strong feelings: Some professors ban laptops and smartphones as a distraction, while others see disengaged students as a sign that instructors need to change how they teach. Colleagues should regularly share ideas and strategies to make well-informed decisions.

Good teaching is critical, but the means and methods to improve effectiveness are not always straightforward. Faculty members need incentives and professional support to try new things and figure out what works. Academic leaders should recognize and promote the value of innovation, but not foist new tools and techniques upon the faculty. Just as every student is unique, so is every instructor.

Institutions must position themselves to foster experimentation and innovation through training faculty and staff members, testing new ideas, and scaling up successful strategies. In the final section, we will explore how to manage these and other changes on campus.

---

**FUTURE OF LEARNING GLOSSARY**

**Active learning:** instructors’ use of group discussion, problem solving, projects, and other classroom activities that require student participation and direct engagement.

**Adaptive learning:** an educational approach that uses software to modify content and pace of delivery based on proficiency. A student who performs poorly will be given additional instruction, while a student who masters the concepts will advance.

**Augmented reality:** a view of a real-world environment enhanced with computer-generated information. A student may hold up a tablet to a machine, for example, and see a schematic diagram to take it apart.

**Blended learning:** a hybrid of online and face-to-face learning.

**Flipped classroom:** a teaching model in which an instructor asks students to first engage with material on their own, often online, then uses class to deepen their understanding through group work, exercises, discussions, and projects.

**Gamification:** an educational model that incorporates elements of video-game design to more deeply engage students, who may choose from options that lead to different exercises and outcomes.

**Instructional design:** the process of designing an academic course using a combination of technology, learning science, teaching strategies, learning goals, and other techniques to create an effective educational environment.

**Learning-management system (LMS):** software that delivers and tracks academic courses and student data.

**Massive open online courses (MOOCs):** courses that deliver recorded lectures and other material over the internet on a large scale and are open to all.

**Open educational resources (OER):** learning materials designed to be free for instructors and students through open licensing.

**Personalized learning:** a type of instruction in which teaching, courseware, and learning environments are tailored to students’ needs, knowledge, and learning behaviors. Students advance at their own pace and are continually assessed on their knowledge.

**Predictive analytics:** the use of data, artificial intelligence, modeling, and machine learning to predict how students will behave. Identifying patterns can help colleges develop effective interventions.

**Virtual reality:** a simulated reality that allows students to experience different environments, like an archaeological site or the inside of a cell.
Managing Change

As academic leaders grapple with the tremendous changes facing higher education, from a decline in public support to a growing reliance on technology, they are likely to find that effective management requires new and different skills, systems, and supports than exist on many campuses today.

Faculty and staff members will increasingly need to understand and use data, technology, and analytics effectively in and outside the classroom. Departments and divisions will be expected to design a coherent educational experience and to ensure that all students get an equitable shot at success. Administrators must find the resources to develop and test new ideas that will produce more engaged, informed, and prepared graduates.

College leaders must plan for that future yet face many barriers to innovation. Some are structural: Departments and divisions operate independently, even as the complexity of higher education demands more collaboration. Some are financial: Teaching reforms and technology updates call for new expertise and personnel. And some are cultural: Saying that an institution values innovation is easier than systematically supporting and rewarding it.

Yet the risks of maintaining the status quo are high. If colleges can’t ensure that all students are set up to succeed, the pathway to a degree is clear, and a degree is a stepping stone to a meaningful life and career, then public confidence may crumble. Institutions’ financial stability and higher educa-

TAKEAWAYS

Innovations in teaching and learning hinge on strong leadership, including clear directives, meaningful incentives, and support for campuswide collaboration.

The hype around ed tech can distract from the real challenges of educational reform. Technology is a tool, not a solution.

A growing number of college networks are sharing resources, developing best practices, and undertaking experiments to improve student success.

The use of data and predictive analytics, outsourced or not, raises profound ethical questions and poses privacy challenges for colleges.
tion’s relevance would be compromised.

This section will highlight key concerns in managing change, including critical issues like data ethics that academic leaders must consider. Finally, it will describe creative approaches to overcome challenges to improving teaching and learning.

**Building Infrastructure**

Developing institutional capacity to experiment and innovate depends on four key elements.

- **Strong leadership**
  Innovative campuses need leaders who set priorities and allocate necessary resources. That’s particularly important for broad, complex initiatives such as data-driven decision making, says MJ Bishop, director of the University System of Maryland’s William E. Kirwan Center for Academic Innovation.

  Without direction from the top, an institutional-research office, student-affairs division, and information-technology unit might not work collaboratively. “At the end of the day,” says Bishop, “change happens when the president is beating on the table and saying, ‘We will do this, and you need to get together and figure out how to make this happen.’”

- **The talent and skills to develop and execute a plan**
  Effective leaders need senior administrators able to shape and carry out a vision. They may hold titles like chief analytics officer, vice president for student success, director of digital learning, or vice provost for academic innovation. Their mission, broadly speaking, is to promote experimentation and reform across campus, not only in pockets.

  More than 200 institutions now have senior administrators with “innovation” or “digital” in their titles, and a similar number have online-learning positions connected to academic innovation, according to a report by the consulting firm Entangled Solutions. An innovation officer may be responsible for studying peer institutions to create a set of best practices, cultivating buy-in among different campus constituencies, or developing new systems to accelerate change. Many online leadership positions are less than seven years old, according to a survey by Eric E. Fredericksen, associate vice president of online learning at the University of Rochester.

  Trustees also must keep up to date. According to KPMG’s Higher Education Industry Outlook Survey, 90 percent of college leaders believe that their board members need to improve their skills to effectively set their institution’s technology agenda.

- **Direct, continuous communication with the faculty**
  Campus leaders must initiate frank, regular discussions about governance, workload, and resources — and follow up.

  Plymouth State University, which is revamping its general-education curriculum in response to enrollment declines and changing work-force demands, plans to replace departments and colleges with clusters that promote interdisciplinary work.

  Those radical changes have made the faculty anxious, but the president, Donald Birx, has won praise for keeping the lines of communication open, providing evidence for why change is needed, and

  “Change happens when the president is beating on the table and saying, ‘We will do this, and you need to get together and figure out how to make this happen.’”
3.1: WHO’S DEPLOYING WHICH TECHNOLOGIES?

Campuswide use, as reported by college IT leaders, is not as common as it may seem.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Institutionwide deployment</th>
<th>Expanding deployment</th>
<th>Planning or piloting initial deployment</th>
<th>Unaware or not yet adopting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active-learning classrooms</td>
<td>12%</td>
<td>39%</td>
<td>25%</td>
<td>24%</td>
</tr>
<tr>
<td>Technologies for planning and mapping student educational plans</td>
<td>7%</td>
<td>24%</td>
<td>33%</td>
<td>35%</td>
</tr>
<tr>
<td>Predictive analytics for student success</td>
<td>7%</td>
<td>22%</td>
<td>35%</td>
<td>35%</td>
</tr>
<tr>
<td>Open educational resources</td>
<td>4%</td>
<td>22%</td>
<td>28%</td>
<td>46%</td>
</tr>
<tr>
<td>Adaptive learning</td>
<td>12%</td>
<td>23%</td>
<td>64%</td>
<td></td>
</tr>
<tr>
<td>Augmented and virtual reality for teaching and learning</td>
<td>9%</td>
<td>30%</td>
<td>60%</td>
<td></td>
</tr>
</tbody>
</table>

Note: Percentages may not add up to 100 due to rounding. Source: Educause Center for Analysis and Research, 2018 Strategic Technologies Data Table.

not being too prescriptive about how it happens.

• **Doors open for collaboration**

  Student success touches on so many divisions, from academic departments to the registrar’s office, that structures for effective collaboration are key to managing change.

  San Francisco State University created its Division of Undergraduate Education and Academic Planning to put curricular reform, advising, experiential learning, and other student-success efforts under one roof. “It helped us institutionally close the communication loop, so we could use the feedback we were getting from assessment to directly apply it to curriculum development,” says Jennifer Summit, provost and vice president for academic affairs. The university is now reforming undergraduate majors.

**Faculty Training and Technical Support**

As teaching and curricular design demand greater sophistication, colleges are hiring specialists in instructional design, learning science, academic technology, and web production.

Learning scientists can share with faculty members the latest research on learning theory, translate that into new teaching practices, and evaluate outcomes. Instruc-
tional designers can help instructors create materials for new or revamped hybrid and online courses. Academic technologists can advise faculty members on tools that would work best for them. Web producers can help execute new ideas.

Some institutions run training programs conducted by such specialists for faculty members who want to do more with technology. At Oregon State University, professors who intend to design an online course complete a six-week training on pedagogy, design, and learning assessment. "Not every faculty member comes with that knowledge," Shannon Riggs, director of course development and training for Oregon State’s Ecampus, told The Chronicle this fall. The University of Central Florida runs a similar 10-week course (See Page 33).

Staffing and training cost money, of course. It’s no surprise that institutions with ample resources or those focused on online education tend to hire specialists and aim to build capacity more broadly.

Yet more colleges need to truly invest in professional support if curricular reform, effective teaching, and well-integrated education technology are institutional goals. Many faculty members and administrators feel deeply frustrated with the status quo on their campuses.

Digital-learning initiatives are rarely being executed strategically, and faculty are “woefully under-supported,” found a survey by Tyton Partners and the Babson Survey Research Group. Less than 40 percent of chief academic officers think their faculty members use digital tools effectively, according to the Association of American Colleges & Universities.

Some campuses have discovered economical ways to share resources. Central Michigan University creates teams of up to seven faculty members who are designing online courses and pairs them with one instructional designer. The designer brings in librarians, tech specialists, and others as needed, while faculty members share ideas and strategies with one another. A course-production support system streamlines basic tasks like uploading files. The university has doubled the rate at which it can create new courses without additional hiring.

Incentives to experimentation and innovation make a difference. Academic leaders should consider stipends or course leave as part of any training program. And tenure-and-promotion guidelines should recognize effective teaching.

### Hubs and Networks

Many campuses feature some type of teaching-and-learning center. Others have units dedicated to academic innovation. Their charges often include improving teaching but may stretch beyond that to curricular reform, learning analytics, and academic technology.

At Michigan State University, the Hub for Innovation in Learning and Technology has driven several student-success efforts. A learning-analytics group brought together staff members from the registrar’s office, provost’s office, student services, institutional research, and information technology to encourage more incoming freshmen to take a full course load, a key indicator of future academic success. In one year, the percentage of students taking 15 or more credits jumped from 28 percent to 42 percent.

External collaborations can also spark change. A growing number of alliances among colleges promote best practices and provide support for experiments to improve student success.

- The University Innovation Alliance is a coalition of 11 public research universities working to expand new approaches to
3.2: FACULTY FIND LIMITED RESOURCES TO EXPLORE DIGITAL COURSEWARE

Administrators are somewhat more likely to see options for training and support.

<table>
<thead>
<tr>
<th>Offered to all</th>
<th>Offered to some</th>
<th>Not offered</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty</td>
<td>Administrators</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Faculty training in new methods and practices</td>
<td>30%</td>
<td>30%</td>
<td>21%</td>
</tr>
<tr>
<td>Administrators</td>
<td>48%</td>
<td>32%</td>
<td>15%</td>
</tr>
</tbody>
</table>

| Faculty        | Administrators  |
| Assistants/colleagues to help faculty teaching in digital environments | 23% | 26% | 29% | 21% |
| Administrators | 27% | 30% | 35% | 8% |

| Faculty        | Administrators  |
| Ability for faculty to attend events on digital learning | 21% | 36% | 20% | 22% |
| Administrators | 23% | 53% | 17% | 7% |

| Faculty        | Administrators  |
| Opportunities for promotion, recognition, and awards | 14% | 17% | 41% | 29% |
| Administrators | 14% | 18% | 55% | 13% |

| Faculty        | Administrators  |
| Stipends to explore new methods and products | 4% | 16% | 55% | 26% |
| Administrators | 12% | 37% | 45% | 6% |

| Faculty        | Administrators  |
| Time off from teaching to explore new methods and products | 13% | 60% | 24% | 7% |
| Administrators | 4% | 28% | 61% | 7% |

Note: Percentages may not add up to 100 due to rounding.
When it comes to digital innovation, liberal-arts colleges face unique challenges. They pride themselves on providing intensive, highly individualized academic experiences, but many lack the resources to experiment broadly with new technologies or teaching methods. Some have chosen collaboration as one way forward. Members of the Liberal Arts Consortium for Online Learning share ideas, promote faculty development, and explore new technologies. The Council of Independent Colleges’ Consortium for Online Humanities Instruction, with support from the Andrew W. Mellon Foundation, focuses on building capacity, improving learning outcomes, and reducing costs in upper-level courses.

Recently the Teagle Foundation evaluated a three-year experiment by a group of college consortia to find sustainable models for integrating online education into residential liberal-arts programs. Faculty members designed new degree programs, introduced hybrid models, and created flipped classrooms. Here are some of the lessons learned, from a report produced with the research-and-consulting service Ithaka S+R.

- Collaboration helps spread the burden of developing new instructional resources among institutions and faculty members, drawing on the strengths of each one.
- Technology-enhanced education can create opportunities for in-depth discussion with students, contradicting the impression that online education limits engagement.
- Partnerships increase academic options for students, who can take courses across campuses.
- This work is extremely time consuming, making it difficult to sustain without continued financial and administrative support.
- Students don’t necessarily flock to new online or hybrid classes, whether because of their initial skepticism or colleges’ insufficient promotion.

As part of the project, Lorna Taub-Pervizpour, a professor of media and communication at Muhlenberg College, helped create a documentary-studies minor with Lafayette College and Lehigh University. The institutions developed three new courses focused on digital technology, with a combination of online and face-to-face classes. Students worked together on documentaries about their local communities.

“If the quintessential liberal-arts education is rooted in experiential learning, collaboration with students and faculty, and a sense of place,” Taub-Pervizpour says, “those things digital collaboration can amplify.”

Some colleges have devoted significant resources to digital innovation and student-success technologies, pursuing projects that other campuses might watch. At Davidson College, which created a digital-innovation team in 2016, a group of faculty members and students piloted a program last year, called the Collaboratory, to reimagine the first year of college. It involved cross-disciplinary courses and immersive-learning trips around the country to study American culture. The idea was to see what professors could come up with without the constraints of the traditional classroom and credit hour, says Kristen Eshleman, Davidson’s director of digital innovation.

The college is also exploring how to combine practical skills with a liberal-arts education, transforming an abandoned textile mill near campus into an entrepreneurship center, with classrooms and workspaces for business ventures. To develop new strategies for student success, Davidson is rethinking some of its gateway courses in STEM.

“What we’re really focusing on now,” Eshleman says, “is how to create room for experiments.”
student success. In three years, the group increased its total number of low-income graduates by 25 percent.

- **Unizin**, a collaboration of 25 universities that together enroll 900,000 students, is designed for sharing resources and ideas on educational technologies. It also promotes open educational resources.

- **EAB**, an education consultancy, runs the **Student Success Collaborative**, a group of more than 450 colleges working to increase retention and graduation rates through analytics and other measures.

- **The Digital Learning Solution Network**, funded in part by the Bill & Melinda Gates Foundation, is a new collaboration among 13 organizations with a focus on digital learning and student success. Members include the Association of Public and Land-Grant Universities (APLU), the Online Learning Consortium, and Achieving the Dream.

- **The Liberal Arts Consortium for Online Learning** comprises 11 small colleges exploring new technologies and pedagogies with a focus on active learning, quantitative reasoning, and language.

A number of higher-education associations also run projects on digital technology, student success, and curricular reform. They include the APLU’s Personalized Learning Consortium, the American Association of State Colleges and Universities’ Re-Imagining the First Year of College, and the Council of Independent Colleges’ Consortium for Online Humanities Instruction.

Academic leaders looking for guidance and technical assistance in the complex and ever-changing realm of teaching and learning have no shortage of places to turn for support, case studies, and new ideas.

**Setting Expectations**

If there’s one thing the ed-tech industry thrives on, it’s hype. Investors are eager to chase the next hot thing. In 2017, ed-tech investments hit a high of $9.5 billion worldwide. College administrators can fall prey to the buzz, seeing new technology as a quick fix to complex problems. “Leadership can be very starry-eyed about how easy it is to implement,” says Susan Grajek, vice president for communities and research at Educause. “It’s actually really, really hard. There’s no easy button.”

Austin Peay State University learned that lesson with Degree Compass, its course-selection tool powered by predictive analytics. Backed by foundation money and bought by an education-software provider, it attracted national attention. But in recent years, graduation rates at Austin Peay haven’t budged, and college officials no longer think the tool has lived up to its promise. Student success is challenging, Loretta Griffy, a math professor and associate provost for student success, told the ed-tech information company EdSurge. And larger forces, like growing enrollments, complicate the picture.

Big-data analytics may be able to identify a problem, says Mark Salisbury, assistant...
Academic leaders may be tempted to try shortcuts and buy bundled solutions, whether in analytics or teaching tools. But technology is not a solution, it’s an instrument. That means any conversation should start by identifying the problem at hand. Figure out what types of interventions might help, and only then evaluate the products on the market — or consider developing your own — designed to do that work.

College leaders should also be mindful that technology can exacerbate economic
divides on campus. More than half of chief academic officers say access to devices is a problem for their students, according to the Campus Computing Project. Before increasing the use of digital technologies, survey students to investigate the impact a move might have on them.

Digital or internet-based materials that are not fully accessible to students with disabilities can be a barrier to learning and introduce legal risks. The U.S. Department of Education’s Office for Civil Rights has seen a big uptick in complaints on that issue. Cyndi Rowland, executive director of WebAIM at the Center for Persons With Disabilities at Utah State University, recently provided several recommendations to colleges. Designate a person responsible for IT accessibility, make accessibility a requirement of all new digital tools, and train faculty members and others who create digital materials, she said.
Data Ethics

The use of predictive analytics in particular raises profound ethical challenges. Early-warning systems that flag students at risk of failing, adaptive courseware that guides students based on performance, and advising systems that map out academic paths hold great potential. When designed and used properly, analytics systems can help colleges provide personalized, nuanced, timely support that can make a positive difference in a student’s academic career.

But analytics can also have unintended consequences. If algorithms use demographic data without sufficient attention, colleges may end up engaging in racial, ethnic, or socio-economic profiling, such as steering students from historically underrepresented groups away from rigorous majors. An early-alert system put in place without adequate care could be harmful. A story told at a recent conference went like this: A working mother got an alert that said if she missed one more class, she would be dropped. She saw it as a sign, and stressed out by the pressures of family and work, she simply withdrew.

Ethics get trickier when third parties are

3 Tech Tools Designed by Academics to Foster Learning

The University of Michigan created its Office of Academic Innovation to support curricular reforms, experiment with emerging technologies, and cultivate new forms of teaching. Among many projects, three educational tools it helped develop have proved popular on campus and beyond.

ECoach

The idea: Electronic coaching programs are part of the student-success movement, designed to put big data and artificial intelligence in the hands of students to guide them through college.

The tool: A professor and his research team created ECoach to support undergraduates in introductory STEM courses. The interactive program lets students see where they stand academically relative to peers, tracks their progress, provides study guides, and offers advice on how to succeed in class. Professors can populate course pages with practice exams and other material. Thousands of students now use the tool, and Michigan plans to expand it to admissions and career counseling.

GradeCraft

The idea: Gameful instruction is a method of course design that engages students by asking them to make choices, allowing them to test hypotheses, and giving them immediate feedback.

The tool: A professor and a doctoral student designed GradeCraft, a learning-management system, to encourage students to experiment more in their classes and take some control over how they learn. Through the system, a professor can give students different options to demonstrate mastery of the material, such as write a research paper, produce a series of blog posts, or take a final exam. Students decide what they want to do to earn points toward their final grade. Dozens of professors at Michigan use GradeCraft, which is being licensed to other colleges and schools.

M-Write

The idea: Writing can help students grasp material and improve critical-thinking skills, but without help, professors of large courses can realistically assign only so many papers. With tools like automated peer review, technology can lighten the grading burden.

The tool: Two professors created M-Write to allow instructors to give conceptual writing prompts, responses to which an automated text-analysis system reads to flag for the instructor those students most in need of help. Feedback also comes from student coaches and peer review. Michigan hopes to expand the tool to reach 10,000 students.
involved. Colleges hire vendors to mine and map student data, deploy advising software, and set up adaptive courseware. Those systems often contain proprietary algorithms, obscuring how and why different data points are collected and evaluated. And college leaders must ask: Is the information secure? What safeguards are in place for student privacy?

“This landscape is a Wild West,” says Mitchell Stevens, an associate professor at Stanford University’s Graduate School of Education who has pushed for colleges to develop ethical standards on educational data. “There are precious few protocols or understandings for responsible use.”

Those concerns may cast doubt on outsourcing. If colleges can pull it off, they should invest in their own research and development rather than cede creation of analytics and learning software to outside companies, Candace M. Thille told The Chronicle in 2016. Thille, who helped launch big data in teaching and learning through Carnegie Mellon University’s Open Learning Initiative, is now at Stanford’s education school.

That may not be realistic, as investors continue to pour millions into ed tech, and colleges with already strained budgets find it difficult to build complex tools and systems in-house.

And best practices have yet to emerge. Stevens and Martin Kurzweil, director of the Educational Transformation Program at the nonprofit consultant Ithaka S+R, convened a group of academics, tech executives, and policy makers two years ago to discuss ethical norms on the use of student data. Ithaka released a report, “Student Data in the Digital Era.” But change has been slow, says Stevens. “The development of policy has been piecemeal, incremental, and local,” he says. “There has not been a sustained national conversation.”

Meanwhile, some vendors have begun their own discussions of data ethics. Blackboard assembled a group of thought leaders from universities, nonprofits, and other organizations late last year to develop standards for the design and application of AI in education.

Advice on ensuring the proper use of data, designing unbiased models, and intervening with care recently came from New America, in the report “Predictive Analytics in Higher Education: Five Guiding Practices for Ethical Use.” Among its recommendations for colleges:

• **Involve stakeholders from across campus.** A coordinated approach to analytics will require input from admissions, student affairs, career services, institutional research, information technology, faculty, students, and vendors.

• **Define your goals.** Clarify the problems you want to solve, the possible unintended consequences, and how you will measure outcomes.

• **Evaluate institutional capacity.** New tools often require new people and systems to make them effective.

• **Examine the type and quality of data you are using.** Early-alert systems won’t accomplish much if they are using lagging indicators, like GPA. Adaptive courseware will fall short if it’s designed for students unlike your own.

• **Write clear policies.** Who owns and who may access student data? Develop legally vetted policies to ensure privacy and ethical use.

As college leaders prepare for the future of learning, they must balance a complex set of issues and take calculated risks. Thoughtful investigation and discussion before any major decisions are vital. And continued attention and strategic investments as institutions test and adapt new systems will go a long way toward ensuring all students receive the best education possible.
Who's Doing What to Improve Learning

This report features the following institutions.

**Arizona State University** is a leader in innovative digital teaching and learning.

**Assumption College** is home of the Center for Teaching Excellence, which supports pedagogical innovation.

**Austin Community College** recently created a 32,000-square-foot learning laboratory.

**Austin Peay State University** developed the Degree Compass course-recommendation system.

**Ball State University** is known for its immersive-learning programs, in which students and faculty members collaborate on community-based projects.

**California State University at Fullerton** aims to increase the percentage of students who participate in experiential learning through financial and other supports.

**California State University system** plans to eliminate all noncredit remedial courses and enroll students in college-level courses with supplemental tutoring, among other supports.

**Central Michigan University** offers training for faculty members who are designing online courses.

**City University of New York** is home to the Futures Initiative, a program that promotes innovation and equity.

**Colorado Technical University** is a leader in the use of adaptive courseware.

**Community College of Baltimore County** helped spearhead a national movement to streamline community-college graduation requirements into pathways with clear course sequences.

**Davidson College** has been experimenting with digital innovation and student-success initiatives.

**Duke University** is using MOOCs in new ways, including offering a course to low-income high schoolers.

**Elon University** requires all undergraduates to participate in at least one experiential-learning activity before graduating.

**Furman University** has made high-impact practices a priority for undergraduates.

**Georgia Institute of Technology** is experimenting with AI-driven teaching assistants in the classroom.

**Georgia State University** is a leader in the use of predictive analytics to increase undergraduate retention and improve student performance.

**Grand Valley State University** incorporated effective teaching into its tenure and promotion standards.

**Harvard University** invested $40 million to improve teaching and learning.

**Lorain County Community College** revamped academic and advising programs to raise graduation rates.

**Massachusetts Institute of Technology** is an early adopter of active-learning practices.
Michigan State University created the Hub for Innovation in Learning and Technology to spark reforms on campus.

Muhlenberg College partnered with Lafayette College and Lehigh University to create a documentary-studies minor with support from a grant for digital teaching.

North Carolina State University is an early adopter of active-learning practices.

Oregon State University runs a six-week training program for faculty members who want to design an online course.

Pennsylvania State University is experimenting with immersive technologies, including a project that allows aspiring teachers to interact with virtual students.

Plymouth State University plans to replace departments and colleges with clusters that promote interdisciplinary work.

Purdue University is creating digital education technologies, including Hotseat, an app that allows students to take polls and have backchannel discussions during class.

Rice University is home to OpenStax, a nonprofit publisher that creates products and support systems to bring open courseware to scale, primarily in large introductory courses.

San Francisco State University created the Division of Undergraduate Education and Academic Planning to put curricular reform, advising, experiential learning, and other student-success efforts under one roof.

University of Central Florida is a leader in online education and the use of adaptive courseware.

University of Georgia requires all undergraduates to participate in at least one experiential-learning activity.

University of Maryland at College Park built a high-tech teaching and learning center, where professors can experiment with adapting their teaching to a variety of classrooms.

University of Maryland University College spun off Heliocampus, a data-analytics provider, from its in-house analytics system.

University of Michigan created the Office of Academic Innovation to support curricular innovations, emerging technologies, and new forms of teaching.

University of Minnesota-Twin Cities has created a number of active-learning classrooms.

University of Missouri system has a partnership with McGraw-Hill Education to reduce the cost of e-books by nearly 40 percent.

University of South Florida is a leader in predictive analytics to improve retention, graduation, and student success.

University System of Maryland supports the William E. Kirwan Center for Academic Innovation, designed to promote change on all system campuses.

University of Washington runs a program that allows doctoral students to shadow Seattle-area community-college professors as they teach and advise students.
The Path Forward

The future of learning is metrics and interventions. Colleges must deploy big data and analytics to dissect the educational experience and tailor it to students’ abilities and needs, with clear goals and measurable outcomes.

Or perhaps the future of learning is engagement and impact. Colleges must provide new, exciting activities and programs in and outside of class, for students to explore virtual realities, grasp complex topics and skills, and immerse themselves in real-world problems.

These drastically different visions of the future convey complicated and sometimes competing ideas for what higher education should be. To be effective, academic leaders need to understand the hopes and concerns behind those visions. As skepticism about the value of college grows, policy makers are demanding higher graduation rates and a more transparent, affordable, and meaningful experience for all students. Families and employers want strong preparation for a dynamic world that requires nimble, creative workers.

Change is crucial. How will colleges respond?

Technology drives many of the possible solutions that reformers advocate. It can make higher education more accessible through online courses and open educational resources. It enables professors to enliven their teaching with tools and techniques like interactive courseware and flipped classrooms.

But many offerings are still untested. Will they gain traction and deliver results? The ideal predictive-analytics system does not yet exist. Whether guided pathways really help students through college remains to be seen. And the risks of using big data to engineer the educational experience may prove too daunting for large-scale adoption. Where is the line between guiding students and manipulating them?

Mitch Daniels, president of Purdue University and former governor of Indiana, has raised that question. “People serene in their assurance that they know what is best for others will have to stop and ask themselves, or be asked by the rest of us, on what authority they became the Nudgers and the Great Approvers,” he wrote in The Washington Post in March.

Even technologists warn against seeing technology as the answer, though the multibillion dollar ed-tech industry may sell it that way.

“The challenge right now is that people use ‘predictive analytics’ as a marketing term. They say, ‘Predictive analytics is going to fix your retention problem,’” says Mark Milliron, a former deputy director at the Bill & Melinda Gates Foundation and co-founder of Civitas Learning, an education-analytics company. “It can help with your retention problems, but needs to be done well. It has to be part of an infrastructure and culture change.”

Defining goals, identifying solutions, and evaluating outcomes are a lot harder than they sound. The ed-tech buzz can confound academic leaders trying to determine what will work for their campus. Siloed departments and divisions mean that internal conversations don’t happen as best they should.

On the plus side, a host of organizations and institutions are experimenting with and studying the effects of new approaches to teaching and learning and new strategies for student success. While each institution has its own circumstances and culture, there are enough common challenges that no college needs to reinvent the wheel. In an era of tight budgets and scant resources, collaborations can help, like the University Innovation Alliance, a group of public research institutions, and the Liberal Arts Consortium for Online
Learning, both of which are developing and testing new models.

Some other projects worth watching:

• **Strong Start to Finish**: Led by the Education Commission of the States and supported by several foundations, this uses evidence-based practices to try to increase the number of low-income, minority, and adult students who complete first-year math and English requirements and continue their studies.

• **Engaging Adjunct Faculty in the Student Success Movement**: Led by Achieving the Dream, this helps six community colleges design programs for adjunct faculty members (who teach more than half of community-college courses nationally) to improve their teaching and engage more deeply in student-success efforts.

• **Open Textbooks Pilot**: In its recent budget bill, Congress set aside $5 million for a competitive grant program for colleges to create or expand the use of open educational resources.

• **The Open Educational Resources Degree Initiative**: Led by Achieving the Dream, this focuses on redesigning degree programs using free materials in place of costly textbooks at 38 community colleges.

What at first seems revolutionary may prove simply evolutionary. Massive open online courses were once hailed as the beginning of the end of traditional institutions. As the hype cycle wound down, educators re-examined what MOOCs could reveal about how students learn online. Today a number of colleges are combining MOOCs and other online tools with traditional face-to-face teaching.

Colleges are fundamentally conservative institutions for good reason. The long process of accumulating and transmitting knowledge from generation to generation is not served well by constant disruption. But deep structural challenges call for reform of the higher-education industry. That’s even as many faculty members — especially adjuncts — don’t have the time or resources to experiment with teaching, and most divisions are too busy putting out fires to reflect on new strategies for student success.

A decade from now, educators may look back on this moment and see the early stages of a profound transformation or a squandered opportunity to remake college. Technological and other innovations could catalyze changes to the educational experience or remain on the fringes, because faculty and staff members are too hamstrung, too overworked, or too uncertain to move forward.

If colleges hew to tradition, many will find themselves in a precarious position. As the number of 18-to-24-year-old students declines, and the share of students who need extra support increases, enrollment and tuition revenue may shrink. The value of college may not keep up with a fast-changing, high-tech economy. And public officials will no doubt hold institutions to account, perhaps with more stringent oversight.

With effective reforms, college can live up to its promise as an engine of opportunity — a place where all students, regardless of background, can pursue their ambitions. Where education is not about tests, but transformation.

When someone asks if it works, educators will no longer have to say “Trust us.” The answer will be clear.
**RECOMMENDATIONS**

**Listen to people on the front lines.**

Effective reforms start with a clear understanding of the problems at hand. What do student-affairs officers and advisers say they need to do their jobs well? What frustrates other divisions that touch on student success, including the registrar’s office, institutional research, and financial aid? What supports do instructors want to experiment with new technologies, teaching methods, or course design? Where do deans and other senior administrators see gaps, silos, and roadblocks that inhibit campuswide change? Doing detective work up front will help you avoid searching for solutions before knowing what problems you’re trying to solve.

**Review your campus’s skills and systems.**

Much of the work to improve teaching and learning requires new skill sets and infrastructure. That includes newly hired or re-trained colleagues who understand how to mine and map data; who are experts in education technology, learning science, and curricular design; and who can manage complex, cross-departmental projects.

**Promote collaboration.**

No one person or department can tackle these challenges, so teams may be the best way to seed innovation. Some colleges have created innovation hubs to bring people together. Ad-hoc groups organized around a particular problem or project can also be effective — with the right people, clear goals, and sufficient resources for the job. Such teams need buy-in from trustees, the president, the provost, and other senior leaders. Otherwise faculty and staff members asked to participate may see the work as one more item on their to-do lists — or one more fad to endure until people lose interest.

**Further Reading**


Pomerantz, Jeffrey, and D. Christopher Brooks. “ECAR Study of Faculty and Information Technology,” Educause Center for Analysis and Research, October 2017.


Don’t fall for the hype.

Many ed-tech tools are new and untested on a wide scale. You may want to believe that expensive software will quickly provide the answers you need to raise retention and graduation rates and improve learning. The truth is that data-driven decision making and classroom innovations take a lot of work. Expect to experiment, stumble, and perhaps fail — maybe a few times — before you find what works for your institution.

Ask the tough questions.

What are your institution’s thorniest and most persistent educational weaknesses? What don’t you know about your students? Do you have the capacity to go all-in on big projects, or do you need to start small and scale up? Do your faculty and staff buy in to your plans, and if not, why not? What ethical issues might arise if you introduce more intrusive forms of tracking, monitoring, advising, and guiding students? By being frank with all campus constituencies about your problems, capacity, and limitations, you can set realistic goals and timelines, and keep people updated on progress.

Look to networks for help.

Colleges are notoriously competitive with one another, but many institutions have collaborated on student-success efforts. Groups are publishing their work and sharing it at conferences. Higher-education associations offer training and guidance on topics like education technology and course design. Foundations, too, are fueling this work with the hope of broad adoption. Every institution is unique, but there is no need to reinvent the wheel. Learn from others, and adapt their lessons to your campus.

Related Publications

The Chronicle has produced several reports for campus leaders. These three also explore teaching, learning, and student success.

The Adult Student
The population colleges — and the nation — can’t afford to ignore
About 80 million adults have a high-school diploma but no college degree. The imperative for colleges to serve them has never been greater — in many cases for the institutions’ own financial health. Learn strategies to tailor programs and services to attract and support older students.

The Future of Work
How colleges can prepare students for the jobs ahead
The changing economy demands new and varied skills, and there is often a gap between what employers are looking for and what colleges provide. Hear from industry experts and educators on how to align your academic programs, co-curricular activities, and career center with the dynamic market.

The Future of the Degree
How colleges can survive the new credential economy
What the traditional college degree signals isn’t clear anymore. Will it lose its value? Explore the growing use of alternate measures of skills and competencies — from badges to MicroMasters — and how colleges can better convey what students are learning.

Browse these and other titles at Chronicle.com/Store