USING DATA AND ANALYTICS IN
Campus Decision Making

Accelerate Digital Transformation with Amazon Web Services

Amazon Web Services (AWS) is supporting this *Inside Higher Ed* booklet because we believe the cloud enables institutions to transform their decision making across campus by leveraging data and analytics.

Higher Education institutions are swimming in potentially impactful data—from student records, research data, and alumni records to emails, tweets, and parking reports. But institutions often struggle to figure out what to do with all of that data, how to organize it, and, ultimately, how to glean insights from it. In a recently released study by *Inside Higher Ed*, 74% of Chief Academic Officers and Provosts surveyed felt their institution wasn't very effective at using data to aid and inform decision making.

We know that leaders across higher education want to use data to help them answer big questions—questions made all the more urgent by the COVID-19 crisis. In 2021, higher education leaders are tackling falling revenue from lost tuition, the move to remote learning and the need to identify the most effective ways to deliver course content. Schools need data-backed solutions to these challenges, and they need it quickly.

In fact, it wasn't long ago I was in your shoes, working to overcome these hurdles from within an institution. Before coming to AWS in late 2020, I served as Vice President and Chief Information Officer for The Ohio State University. I also served as vice-chair of Ohio State's COVID response transition task force, responsible for the transition to online learning in spring 2020 and the safe and healthy return to campus for Ohio State students in autumn 2020.

I'm excited to engage with this community in a new capacity as I lead the Education Business Development and Strategy Team at AWS with the mission of accelerating digital transformation across K-12 institutions, Academic Medical Centers, Research, and Higher Education.

At AWS, we are committed to partnering with you to drive efficiencies in your operations and value delivery by integrating cloud technology and data intelligence into all areas of your institution. Contact us to learn how AWS can help your institution, and join our mailing list to learn more about cloud success stories and best practices.

Sincerely,

Mike Hofherr

Mike Hofherr
Director Education Strategic Business Development,
Amazon Web Services

"At AWS, we are committed to partnering with you to drive efficiencies in your operations and value delivery by integrating cloud technology and data intelligence into all areas of your institution."

-- Mike Hofherr, AWS

Introduction

Demographic, economic and other forces -- including a global health pandemic -- are converging on colleges and universities, exacerbating pressure on the institutions and their leaders to operate more effectively and, without sacrificing quality, efficiently.

One path to doing so is by marshaling the vast reams of data that colleges and universities collect about learning, enrollment, finances and other aspects of their operations to help inform decisions, rather than relying on intuition and history.

Different institutions have differing capacities and cultures around the collection and use of data to influence decision making. But over all, higher education lags many other sectors and industries in embracing this approach: a 2020 survey of chief academic officers by *Inside Higher Ed* found that just 23 percent described their institution as "very effective" in "using data to aid and inform campus decision making," down from 31 percent in 2012.

This collection of news and opinion articles explores the landscape of data-informed decision making, predictive analytics and machine learning – highlighting examples of success and some of the potential pitfalls as well.

Inside Higher Ed welcomes your questions, comments and suggestions about this booklet and all things higher education.

--The Editors
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NEWS

'Big Data on Campus'

Authors discuss new book, which addresses the best way for college and university leaders to use data when making decisions.

By Rick Seltzer // November 10, 2020

Amid the periodic enthusiasm for data's ability to revolutionize the way colleges and universities work, it can be easy to forget that having more data available doesn't necessarily translate into leaders making better decisions on campus.

It's a point Karen L. Webber and Henry Y. Zheng make early in their new book, *Big Data on Campus* (Johns Hopkins University Press).

"Despite some newfound emphasis on data analytics, most higher education officials are not yet adept at using analytics to support institutional decision making," they write.

The book is targeted at administrators, institutional researchers, technology workers and graduate students. But it's a useful primer for anyone seeking to understand how higher education leaders can use the large amounts of data that are available on campuses today -- as well as how many are coming up short, plus a host of concerning issues surrounding the appropriate use of data.

Chapters cover topics ranging from principles of good practice to why data analytics can inform admissions decisions to decision making itself. Webber, a professor of higher education at the University of Georgia, and Zheng, senior associate vice president for strategic analytics at Ohio State University, edited the book and contribute in several of its chapters. The result is a range of case studies, examples and checklists for those who want

to look around them and see how data can be harnessed at their own institutions.

Webber and Zheng emphasize several elements that need to be in place before smart data-informed decision making is possible on campuses: people, technology, process and culture. One of the key lessons to remember from a book about data is that the human element can't be ignored.

"Along with more data comes the need to use contextualized knowledge of the higher education organization and analytics strategies that account for the unique situation or population under study, and everyone must be mindful of privacy, ethical, and overall responsible use of the data," Webber and Zhen write.

The two editors combined to answer questions about the book via email. Their responses, which follow, have been edited lightly for style and clarity.

Q: Do you want everyone who reads the book to walk away with one or two key ideas?

A: Gosh, it's hard to pick just two. It's exciting to see the application of data analytics growing in higher education, and we are buoyed by the ways in which some of the techniques related to data analytics can improve student, faculty/staff and organizational success. If we had to choose:

- The ways in which we've thought about the use of data in higher education decision
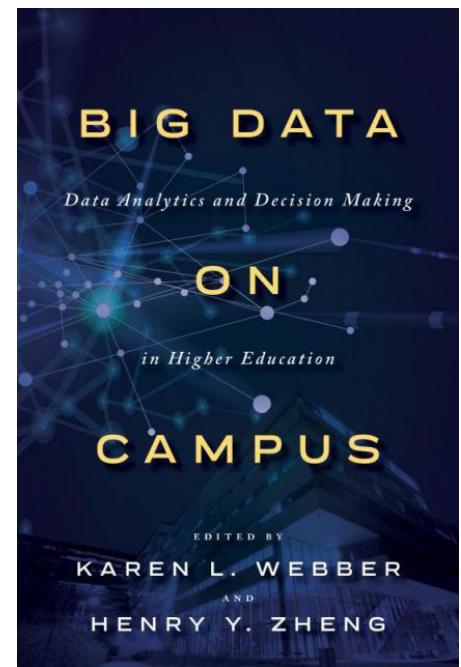
making [have] evolved over the past couple of decades. There's an important distinction between data-informed and data-driven decision making. Whereas data-driven decision making (DDDM) lets the data speak for itself, data-informed decision making (DIDM) considers the context in which the decision is being made. We believe that analytic results are best when the information is examined within the specific situation or context, and that means that in some cases, the algorithmically generated answer or prediction with the highest accuracy rate may not be the best answer for the situation at hand.

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'Big Data on Campus' (cont.)

■ The use of data analytics to build strong and long-lasting data-Informed decision making requires certain kinds of people, technology and processes. It requires senior leaders who have the vision for data-informed decisions as well as knowledgeable and skilled data analysts, software engineers, data visualization specialists and staff who can communicate the findings. It requires devoting capital to a strong infrastructure of advanced technology, and it requires a coordinated campus plan that values the use of data (that has structures in place to ensure appropriate data use and is mindful of security and responsible use).

■ We have to add a third (although not new to our book). Data is only helpful when it is transformed into useful information. Acknowledging the context is essential.

Q: Early in the book, you discuss how organizations can be data rich but information poor -- and how they don't always know how to turn large amounts of data into action. Can you suggest any steps to help college leaders make the jump?

A: Indeed, collecting large volumes and varieties of data [is] possible today; storage in a campus-based architecture or the cloud is relatively easy and less expensive than in the past. This tempts us to collect data for the sake of collecting without having a thoughtful plan for how, when and for what purpose it will be used. An important part of a strong and comprehensive data governance plan includes identifying which data will be used to address certain institutional questions. Start by refining the questions that relate to institutional goals and then identify relevant data that will help to answer those questions.

Q: You outline elements that affect data-informed decision culture in higher ed: people, technology, process and culture. Is one more important than the others, or does one need to be in place first?

A: For optimal and effective implementation, all … are needed. Perhaps, though, it starts with leaders who have a strong vision. These leaders have the ability to apportion resources for the skilled staff (or ensure training to get staff the right set of skills), who can then identify the complement of technology needed. Leaders with vision initiate the processes because they realize that actions build culture. Leaders with a vision also realize that not all activities will be perfect, so they understand and allow for bumps along the way, knowing that building a data-informed culture doesn't happen overnight and requires multiple efforts from many angles.

Q: As technology makes more information readily available for longer periods of time, tension exists between users who want to control their own data -- their own stories about themselves -- and organizations that engage in mass collection of data. If that tension continues, does it have implications for how colleges and universities need to approach big data?

A: Yes! This is such a critical question, thank you for asking. In today's higher education world with the volumes and richness of data, no one unit can easily (nor perhaps should) handle all data requests. It is reasonable and appropriate to have select data users in a variety of offices on campus (such as admissions, financial aid, advising, HR, academic dean's offices), however, it is critical that users receive thorough training on the definitions of the data and any contextual facets that are possible. In most cases, working with other senior colleagues on campus, knowledgeable leaders of institutional research offices should remain central in establishing user training, select data sharing, and ensuring data security through a strong and comprehensive data governance plan.

Q: Could predictive analytics represent an identity crisis for a sector that considers itself a driving force for opportunity and social mobility?`

A: The nature of predictive analytics requires the use of previous data to make predictions about the future. Before a predictive analysis can be done, the analyst must consider if and how the previous data will introduce bias. If we're interested in diversifying the kind of students in higher education with students that were not represented in previous cohorts, then the use of predictive analytics may not help us achieve the goals of greater access for underrepresented students.

Q: It seems that using data well requires a large number of resources, both staffing resources and financial resources. Do you have any ideas on how small institutions with limited resources might be able to overcome this fact?

A: Data-informed decision making is a key to effective institutional management. Start small; prioritize tasks or areas of focus that align with the institution's mission. Finding small successes and building a culture of data-informed decision making will help each institution, large or small, move forward to better decisions.

Q: Was there anything you wanted to put in the book you couldn't fit?

A: A few things:

- We intentionally kept the focus primarily on U.S. institutions. However, we acknowledge there are a number of institutions across the world that are ahead of the U.S. in their initial use of some aspects of data analytics in higher education learning and administration, in particular learning analytics.

- Many other examples of data analytics are available, and we learn of more each week. We already have some and can't wait to gather more case examples to share. We're also eager to get a better idea on which ones are yielding the greatest benefits. What works for one institution may not work as well at another. That may relate to the student population or the culture (and the value seen for data-informed decisions) or both.

- The use of learning analytics that capture multiple data points about an individual student to gauge performance and success, broadly, represents a fundamental shift in the use of data for student success. Prior models typically reported data in the aggregate and were careful to not provide information about individual students. However, many of today's early-alert warning systems seek to gather a variety of data points for student performance at the individual level, often so that faculty members or advisers can help students improve before the end of a term. While the potentials of these alert systems can indeed help, they also have the potential to label individuals which can lead to unintended (negative) outcomes. It's a fine line to walk.

(We are not the first to acknowledge this change, but it's a point well taken.)

Q: What did I miss in these questions?

A: Although the current challenges with the COVID-19 pandemic have forced us to shift our focus to immediate needs, we hope that we don't lose sight of the larger goals and purposes of higher education that include developing a cultured, creative, racially and gender diverse population filled with students who will become our nation's future leaders, thinkers, entrepreneurs and builders of the economy. How can we in higher education ensure our continued movement forward? Data analytics holds great promise for many areas within higher education and now more than ever, the use of data analytics to make data-informed decision is an important key to our future. ∎

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OSU-OKC upskills its workforce and drives real-time decision making with live reporting and analytical modeling

by Brad Williams

Oklahoma State University in Oklahoma City (OSU-OKC), a two-year, technical-focused college, has historically faced challenges with consistent reporting, database management, and analytics. Technology generalists hired to do these tasks required extensive training to successfully extract data from traditional student information systems, manipulate data for state and federal compliance reporting, and generate limited casmpus reporting for operational or academic program review and analysis. Staff turnover and the ensuing loss of knowledge was a source of reporting inconsistencies.

Previously, we relied on cumbersome systems or time-honored structures to meet compliance and effectiveness measures. We either deployed expensive, complex data modeling software systems or had staff manually manipulate data points into meaningful information. Neither approach was cost effective, nor sustainable for a two-year college. To support a new approach, we needed to develop adaptable, analytical modeling. We wanted to be able to make timely, reliable, data-driven decisions responsive to student success, employee excellence, and community relevance. To accomplish this goal, we turned to Amazon Web Services (AWS).

To restructure our data reporting capabilities, we tapped into our existing talent pool. Initially, many of our employees had limited knowledge of reporting and database management, but were open to new possibilities. We needed to identify secure, customizable systems that would be compliant and capable of driving change. We searched for a cost-effective solution with a reasonable learning curve to upskill our university's workforce.

We identified Amazon QuickSight and immediately determined that its functionality and ease-of-use would help us reduce the time required to train staff and develop and deploy reporting. Amazon QuickSight provided us with an affordable and timely path to develop functionality equivalent to Tier-1 research institutional reporting and dashboarding. We can produce market-leading data visualizations, which can help us gather insights to inform data-backed campus decisions.

Within days, in collaboration with our AWS Solutions Architect, we were pulling data from a convoluted repository into Amazon Simple Storage Service (Amazon S3). The ability to store and retrieve volumes of information on a secure and scalable infrastructure is what initially attracted OSU-OKC to AWS. Within four months, we created a functional data lake that contains nearly one million lines of data. We have automated our largest compliance reports, which includes 24 datasets and over 500,000 lines of data.

In this short development time, we have 60 report users that support over 100 degree majors. Previously, the time to produce each one of the degree reports was nearly a week. Thanks to line-level security offered by Amazon QuickSight, data is now immediately accessible and the university maintains privacy required by Family Educational Rights and Privacy Act (FERPA) and other compliance mandates. Being able to set individual parameters allows users to change – with just one click –the entire dashboard and obtain information needed. Key-decision-level data now displays in live dashboards where executives can drill down to find performance and key competitive insights.

For the first time, we now have a full view of our 60-year enrollment history. Long-term enrollment fluctuations and diversity trend data coupled with external employment and economic data has allowed us to create targeted strategies to increase student completion and retention. And, OSU-OKC entered publicly available comparative data from 30 of the state's universities. Using Amazon QuickSight, competitive insights from this data are driving programmatic decisions that were previously not possible. This ease-of-access to insights allows leadership to provide faster market-based curriculum and operational decisions to meet student, industry training, and critical occupational needs.

These are exciting times for my administration and for the students and community we serve. Amazon QuickSight is at the center of OSU-OKC's transformation. Having the ability to drive real-time market change affordably and securely with reliable reporting and information has transformed the way we make decisions and will help us create the workforce of the future.

Brad Williams

Brad Williams became OSU-OKC's fifth president in January 2018. Williams and OSU-OKC's faculty and staff are working to transform the processes, services, and culture surrounding OSU-OKC's student experience.

Assessing the Value of an Undergrad Degree

A new study from *Academically Adrift*'s co-author seeks to evaluate a broad range of student experiences and outcomes as well as new ways to measure learning.

By Lilah Burke // September 27, 2019

A broad and ambitious attempt to understand what students get out of higher education, both experientially and intellectually, took an important step this week at the University of California, Irvine.

Richard Arum coauthored the high-profile book *Academically Adrift*, which evaluated the critical thinking skills students gain in college, with unflattering results for higher education. Arum is now dean of the university's education school, where he is leading a project to survey students' experiences in college as well as learning outcomes that have in the past eluded measurement. Some of the study's 1,000 randomly selected students began the survey process Wednesday.

The project is meant to incorporate a complicated array of student data, ranging from answers to short experience surveys -- where students report what they are doing at the moment, whom they are with and how engaged they are -- to behavior on learning management systems, grades and measures of civic reasoning.

"We'll have the ability to identify student experiences inside and outside the classroom, as well as undergraduate outcomes, in a way that's more rich, complex and deep than anything that's occurred previously in the field," Arum said.

The goals of the project, he said, are to identify tools other institutions can use to do these measurements, identify where students are flourishing and struggling, and use the collected data to improve instruction.

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"Nationally, 40 percent of students who start college don't finish it. And there are not systematic efforts underway to address and systematically put in place support so that all students are learning and developing trajectories so that they can attain their goals in life," Arum said. "You need to have the scientific basis, the high-quality measurement systems in place, in order for those decisions to be informed, evidence based and data driven."

The project was designed to be a first stage and to inform a later effort to develop a similar large-scale study for multiple colleges and universities. At UC Irvine, the study's sample of 1,000 randomly selected students includes 500 incoming, first-year students, 250 junior transfer students and 250 continuing juniors.

Natasha Jankowski, director of the National Institute for Learning Outcomes Assessment, voiced support for the project, but she has concerns around equity in its future application to other institutions. Because the project is focused on highly selective universities and advised by staff at those institutions, she said, it should not be used to create norms for students at other colleges.

"My concern is that something that's made for a particular type of institution, for a particular type of traditional student," she said, "being applied outside of that into a larger student-success conversation at community colleges, minority-serving institutions and institutions with predominantly adult student populations -- that fundamentally will not fit."

For example, holding adult learners, with likely very different experiences from the study sample, to a learning or behavior standard not designed for them could be detri-

mental to their success and make them feel like they do not belong in higher education, she said.

Arum said the project ideally will track students after they graduate and evaluate their success in the labor market as well as their civic engagement.

New tools from Educational Testing Service will be employed to evaluate difficult-to-measure outcomes, such as a student's ability to understand different perspectives, collaborate and problem solve -- skills Arum says are not only essential for labor-market success, but are relevant to creating a democratic citizenry.

"It's not easy. These are complicated things to measure well," he said. "We're not content with taking off-the-shelf measures."

Outcomes and Soft Skills

George Kuh, founding director of the National Institute for Learning Outcomes Assessment, said the most exciting and likely difficult part of the project would be measuring these soft skills.

"I'll be curious to see what they develop to tap these -- sometimes people call them more esoteric outcomes," he said. "If you look at what makes for a successful person postcollege, some of these lesser-talked-about proficiencies are very, very important, especially in the long term and as we think about what's going to matter after college, what kinds of outcomes

are going to portend people's success in jobs that don't exist today."

Academically Adrift, Arum's 2011 book, analyzed students' scores on a tool called the Collegiate Learning Assessment, which measured critical thinking skills. When the study found that 45 percent of students made little to no progress in their scores after two years of college, commentators took to both criticizing the research and declaring an existential crisis in higher ed.

"One of the criticisms of [*Academically Adrift*] was the measurement being not particularly deep and sophisticated," Arum said. "I've been devoted professionally to responding to that criticism, to improving the measurement in higher education."

Arum said he would have liked to have assessed students on discipline-specific learning goals, for subjects like history and biology, but didn't yet have the resources.

While he said the new research, which is backed by the Andrew W. Mellon Foundation, is critical for "demonstrating the value of undergraduate education," he also emphasized that the project is not about confirming pre-existing beliefs.

Jonathan Gagliardi, assistant vice president for strategy, policy and analytics at the City University of New York, Lehman College, and an editor of the book *The Analytics Revolution in Higher Education*, said

that because earnings and employment are easier student outcomes to measure, they can often be the focus of attempts to pin down the value of a degree.

"It's tough to thread the needle between ensuring that folks have those tools to help them have a long life, and a great career and happiness, while at the same token making sure that they've got the skills that they need to get a job immediately," he said. "I think that this project at its heart offers promise to institutions to be able to do just that."

Doris Zahner, chief scientist at the Council for Aid to Education, which makes the Collegiate Learning Assessment, said the project is an important step in the general process of improving institutions and student outcomes. She pointed to a gap between the skills students are graduating with and the skills employers want. The goal, generally and for the council, is to measure that gap and remedy it.

"It's not about, at the end of the day, saying things are good or bad. It's about, how do you inform the institutions to be able to improve how they are supporting students?" Arum said. "We've asked K-12 institutions to do this for decades. We have to bring the same rigor, the same approach to our own institutions to fulfill their promise … to restore the public's faith in these institutions." ∎

Early-Alert Systems Seen as Mixed Bag

Early-alert systems designed to catch struggling students are ubiquitous in higher ed, but not every institution is seeing desired results.

By Lindsay McKenzie // September 11, 2018

When a student misses a class, does poorly on a quiz, fails to turn in an assignment or otherwise seems in danger of flunking a class, what should a professor do?

At Lycoming College, a small, private liberal arts college in Pennsylvania, worried faculty members simply talk to their students or pick up the phone to call the dean and share their concerns.

In an era when many colleges and universities are using high-tech early-alert systems for monitoring and improving student performance -- many promising to boost retention and graduation rates through proprietary student tracking tools and powerful predictive data analytics -- Lycoming's solution seems remarkably quaint.

Some institutions, such as Georgia State University, have had remarkable success with heavily data-driven student success systems. Others, including Lycoming, have not. Despite becoming well-established tools over the past decade at colleges and universities hyperfocused on improving student performance and retention, state-of-the-art early-alert systems haven't been embraced at every institution. Some have resisted the need for in-depth data reporting and gone back to their old ways of measuring student performance. Others have switched frequently between providers, seemingly unable to settle on one that works.

Andrew Kilpatrick, associate dean of student success at Lycoming, said he sometimes had doubts about the college's old-

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school approach. A few years ago, college administrators seriously considered purchasing early-alert systems from leading vendors such as Starfish, EAB and Civitas Learning.

"We saw value and benefit in a lot of them but didn't find one that was exactly what we needed -- there wasn't a slam dunk," said Kilpatrick.

Instead, administrators decided to create their own solution in-house. The system, created by the IT department, prompted instructors to answer a series of questions about their students' performance during the third and sixth weeks of class. The system was used during the 2016-17 academic year, but it was soon obvious that this solution "was not nearly as effective as what we had been doing all along," said Kilpatrick. Rather than raising the alarm as soon as they spotted an issue, faculty members were

waiting to report problems, he said.

And while most faculty members were willing to engage with the new system, not everyone was on board, said Kilpatrick. Telling faculty members when and how to report on student progress "made some people feel like they were teaching high school," he said.

There were also other hurdles, said Phil Sprunger, provost and dean of the college.

The data collected at both the third and sixth weeks "became too much to handle -- it became a distraction," he said.

The homegrown early-alert system also resulted in "a lot of false negatives" with students being flagged as at risk when "they were probably going to be OK," he said. "It was making people feel bad."

Though Lycoming largely went back to its old way of doing things -- asking faculty members to report provisional grades at the sixth

week only -- Sprunger recognizes the university's approach wouldn't work for every institution. Lycoming has around 1,300 students, and relationships between instructors and staff who work in residential life and advising are closer than there might be at a larger institution.

"If we had 5,000 or 10,000 students, our system wouldn't work," he said.

Sandra Kingery, Logan A. Richmond Professor of Spanish at Lycoming, said in an email that college's current system works very well. Faculty members have, since 1994, been asked to give early-assessment grades at the six-week mark to first-year students, transfer students and students who are deemed at risk.

"It's quick and easy to do -- faculty enter the grade a student is getting at that time, and there is a checklist of reasons we can use to explain poor grades (e.g., poor attendance, missed assignments, poor grades on exams etc.)," she said.

When Lycoming tried adding reporting at the third week in addition to the sixth week, results indicated that "having two early assessments didn't seem to improve student success more than having just one," said Kingery. "For that reason, we went back to the single early assessment in the sixth week as we had done previously."

If a problem arises before that six-week mark, faculty members will pick up the phone or write an email to notify the appropriate dean, who is very effective at identifying what's going wrong, said Kingery.

"I would also copy their student adviser, and when applicable, his or her coach," she said.

Kingery said she had never tried

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> I believe it's easy to use, and when I flag a student, I am confident that the Academic Success Center, the student's adviser and I can work together to follow up with the student in question.
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using a more high-tech early-alert system, "but I have a hard time believing that kind of a program would be an improvement to what we're doing already at Lycoming," she said.

"It doesn't seem to me that technology would make us any more effective than we already are at identifying problems and notifying the appropriate people about our concerns," said Kingery. "In fact, I would think any software system would actually reduce our personal connection with our students."

Finding an early-alert system that fits an institution's culture is key to its success, said Fox Troilo, senior research adviser for higher education at Hanover Research. Hanover works with institutions to look at which factors might be causing student attrition by surveying current and past students who have dropped out of classes. This data are then used to create a predictive model that identifies students who are likely to be most at risk. (Note: Hanover does some survey work for *Inside Higher Ed*.)

Universities largely have the same goals for their early-alert systems: they want to improve student retention rates and ensure more students graduate. But which data need to be tracked and collected to achieve these goals will vary by institution, Troilo said.

An important factor for success is ensuring that faculty are engaged in the data-collection process. "There has to be faculty buy-in for these systems to work," he said.

Feleccia Moore-Davis, provost at Tallahassee Community College, knows this firsthand. Earlier this year at the Achieving the Dream annual conference, where member colleges of the nonprofit organization meet to discuss different student success initiates, she told attendees that the college had started using a solution from vendor Starfish in 2012, but after a few years decided to switch to a homegrown solution when the system failed to improve student retention.

At the conference, EdSurge reported that Moore-Davis told attendees that faculty members "hated" the Starfish system. "They didn't understand why they were doing it and they didn't get any

feedback," she said.

The Florida college modified its IT help desk system last year to keep track of alerts. The platform, called TeamDynamix, allows faculty members to create a work order that tells staff in advising or the financial aid office that a student needs help. Alerts must be responded to within 48 hours, and faculty members receive an automatic notification when someone from the college completes the request.

The college is planning to stick with the TeamDynamix system for now.

"Faculty like that they can see into the process," said Moore-Davis. The new system is also saving the college money. The Starfish subscription was around $73,000 a year; the new solution costs under $3,000, she said.

Moore-Davis is somewhat skeptical of the impact that early-alert systems can have on student retention.

"I think the best tool that we have ever used and that we still have access to are our faculty," she said. "They are in the best position to retain our students."

Howard Bell, senior vice president for higher education student success at Starfish, said that since Tallahassee joined Starfish in 2012, technology and approaches to student success have changed significantly.

"Today the way forward for student success in higher ed requires the use of guided pathways," he said. This means that colleges shouldn't take a "single-bullet approach" to student success, but make an "intentional effort" to ensure students and staff have access to multiple resources, including skills assessment, career exploration and academic planning

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and analytics, in addition to early alerts. This comprehensive suite of resources (which are all included in the Starfish offering) in addition to shared data and insights from a network of 467 institutions are what sets Starfish apart from homegrown solutions like Tallahassee's, said Bell. "That's why it costs more," he said.

"Many early adopters of student-success systems have come to realize that change management at the school is just as important an element as the adopted technology," said Bell. He added that in recent years, Starfish and other organizations have been spending more time "helping schools with cultural shifts in campus mind-set and policies that are significant barriers to the successful integration and use of tools by staff and faculty."

Martin Balinsky, a professor of earth science and vice president of the United Faculty of Florida's Tallahassee Community College union chapter, said he was somewhat surprised to hear Moore-Davis report that faculty prefer the current system over Starfish.

"In my experience, the exact op-

posite is true," he said. "Starfish was much more user-friendly, because you could record attendance daily and there was an automated process to flag students to let them know if their grade was below a certain average, or if their attendance had not been good."

By contrast, the new system requires faculty members to contact students twice before they can make a referral, and there is no mechanism for recording attendance.

"It is ludicrous that faculty can only make a referral if they have reached out to a student twice already," said Balinsky. "Faculty do not have time to spend constantly calling or emailing students who have not been attending class."

Balinsky believes the system is "babying" students and is detrimental to student success because it doesn't teach them about "the way the real world works."

"A community college faculty member's primary job should be preparing the best-quality product to give the students, delivering it to them and answering their questions in a classroom or office-hour set-

ting," he said. "Let us do our jobs, let the students learn from both their good and bad choices, and that will be the true key to student success."

Frank Baglione, a professor of history at Tallahassee, also said that he had preferred the Starfish system but acknowledged that when it was introduced, many faculty members disliked it because it required them to take attendance -- an activity that was not previously mandated.

Though Moore-Davis said that the new system gave faculty members greater insight into what happens after they flag a student, Baglione said he was still in the dark about what assistance students receive.

A common response that faculty members receive from the system is "could not get ahold of student," Balinsky said. "So it's pretty meaningless."

Farrah Jackson Ward, associate vice chancellor for academic affairs at Elizabeth City State University in North Carolina, said her institution had experienced encouraging results with its early-alert system but noted "they don't work out of the box."

Elizabeth City State has worked with EAB's early-alert solution since 2015. Initially, faculty didn't get it and only about 50 percent of faculty engaged with the system, Ward said. They said they were too busy and forgot to do it because they weren't reminded.

Now faculty are prompted twice a semester by email to flag any students with issues. The university is also developing training sessions, videos and handouts to ensure that faculty understand how to use the system, what happens when they flag a student and why it's important. As a result, the university now has a 99 percent response rate from faculty.

Margery Coulson-Clark, a professor of social and behavioral sciences at Elizabeth City State, said she likes the EAB system -- particularly how it easy it is to use. EAB sends out an email with a link to the system that doesn't require faculty members to log in. It also sends prompts about upcoming reporting deadlines. Training on how to use the system is "accessible and easily followed," she said, making the use of EAB "less cumbersome for those who are new to it."

Nancy Biggio, associate provost for administration at Samford University in Birmingham, Ala., also uses EAB's solution. She says her institution did a lot of work to encourage faculty, particularly those that work part-time, to use the system.

"Faculty are an inquisitive population -- they ask lots of questions and want to know the reasons for things," she said.

Biggio said the system has become indispensable to staff working in advising and has improved communication across the institution between staff and faculty members. Mary McCullough, chair of the Faculty Senate at Samford, said she personally had "positive experiences with the early-alert system" and believes that it has improved communication between faculty members and advisers on campus.

"I believe it's easy to use, and when I flag a student, I am confident that the Academic Success Center, the student's adviser and I can work together to follow up with the student in question," said McCullough.

Ana Borray, director of professional learning at Educause, said that when it comes to making early-alert systems successful, "technology can only do so much." Engaging faculty members to make reports is important, but so is "closing the loop" to let them know that their reports have been acted on, she said.

Borray said it's not uncommon for institutions to switch between early-alert providers. And a lot of new players are entering the market -- including traditional enterprise resource planning providers. As early-alert systems have evolved, they have also become more complex and costly.

"It wouldn't be uncommon for a university to be paying $200,000 a year," said Borray.

Borray said most institutions that use early-alert systems see some positive impact on retention rates -- but these may be more modest increases than they expected. Some institutions set unrealistic goals, such as increasing retention by 10 percent in a year, she said. And they often don't realize how much time it takes for a system to start working.

"There is no magic," she said. ∎

The Ultimate College Teaming Up in Houston

Houston area colleges and universities are working across sectors and sharing information and data to improve student outcomes.

By Ashley A. Smith // August 7, 2018

Colleges across the country are designing academic and career pathways, improving student transfers between institutions, or reforming how they provide remedial education -- all to improve student outcomes and increase graduation rates.

In Houston, some of the region's two- and four-year institutions have taken those efforts one step further. They are partnering to create pathways across sectors as a way to improve graduation rates not just at individual colleges but throughout the entire metropolitan area. The University of Houston System, which is composed of four institutions; Texas Southern University, a historically black college; Houston Community College System; Lone Star College System; San Jacinto College District; Wharton County Junior College; Victoria College and College of the Mainland have all signed on to the initiative, called Houston GPS, and teamed up with Complete College America to achieve that goal.

The initiative was started four years ago after Tom Sugar, the former president of Complete College America and now vice president of partnerships at EAB, a research and technology services company, had a conversation with Paula Short, senior vice chancellor for academic affairs for the University of Houston System, about guided pathways and other college initiatives to increase student success.

The two decided that focusing on how students go to college and putting the interest of students ahead of the institution was the way to go.

"Ultimately that bet will be good for colleges, too," Sugar said.

Guided pathways are traditionally designed to set an academic course for students from the time they enroll until they graduate. While many of those initiatives decrease the amount of time it takes students to earn degrees, the programs have shortcomings, Sugar said.

He and Short wanted to address those weaknesses. What if they approached guided pathways in the same way as students approach attending college, they asked.

"That may mean supporting students when they change community colleges or transfer from a community college to a four-year school, whenever they do it, either after the first year of community college or transferring after a degree," Sugar said. "That's how students go to school these days."

Sugar then drafted an agreement that would encourage colleges to not only pursue guided pathways but also to align their math courses to specific careers and majors so programs that don't require calculus would not force students to take requisite entry-level algebra classes. The agreement included other popular reforms that colleges have been pursuing separately, such as meta-majors, which are broad, career-oriented content areas that help students identify the major they want to pursue. Colleges would also agree to corequisite remedial or developmental education that requires students to enroll in college-level gateway

English and math courses with additional support.

The agreement also includes seamless transfer between two- and four-year institutions so students would be granted junior-level status once they complete their associate degrees. Colleges would agree to track student progress, using predictive analytics and intrusive advising, and to revise college schedules to make attending classes easier for students who work.

Meanwhile, Short started digging into UH's data and was not pleased with what she found. She learned that students earned 151 credits on average toward a bachelor's degree, although the typical bachelor's degree program requires only 120 credit hours to complete. Researchers have found that excess credits often don't lead to college completion and place students in more debt. As a result, she started having conversations with the community colleges about improving student outcomes. Houston GPS was established soon after.

The agreement calls for combining remedial education with credit accumulation, helping students balance work and college responsibilities, and providing technology to support these efforts.

"They're working with the partner institutions to design academic plans and degree maps that align, and that's nirvana," Sugar said of the college leaders. "They never had conversations like that. It's always been them designing degree maps within their institutions and not looking down the street at … a competitor school and asking, 'What are you doing down there?'"

Last week Houston GPS institutions met with officials from EAB, which is providing the predictive

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> They're working with the partner institutions to design academic plans and degree maps that align, and that's nirvana.
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analytics tools and software colleges will use to offer easily accessible degree maps to students and provide early warning systems of students at risk of failing and real-time tracking of students' success to faculty and advisers. Houston GPS will fully launch across the colleges this fall.

"Technology is the next phase of the pathways work," Sugar said. "Proactive advising requires technology, makes it scalable and more sustainable."

Making the software available to students will also better connect them to advisers and coaches who can help them when they're struggling academically or need support from the financial aid office, for instance.

"We spend a lot of time and energy communicating with students in ways they don't want to communicate," said Wendell Williams, a special adviser to the president at Texas Southern, one of the newest universities to join Houston GPS. "If you make a phone call, 90 percent of our phone calls are not answered, or the number is not correct."

By using the new technology tools, students will get "nudges" to meet with advisers and have access to their degree maps.

The colleges participating in Houston GPS have traditionally been competitors often going after the same types of students. But Houston is growing and remains the country's fourth most populous city, behind New York, Los Angeles and Chicago. The region added more than 95,000 people between 2016 and 2017, according to U.S. Census Bureau data released earlier this year. That means there are plenty of students for each of the institutions to pursue.

There were about 300,000 students in all Houston GPS institutions, Williams said. "But there could be 700,000 students who should be in these institutions."

Getting students to enroll is one thing, but holding on to them and making sure they leave with a degree is another, he said.

The Texas Legislature has also called for colleges to improve their outcomes. In 2015, the state set a goal for at least 60 percent of the state's 25- to 34-year-old resi-

dents to have a college degree or certificate by 2030. Currently, 42.3 percent of that population has a degree or a certificate, according to a 2018 report from the Texas Higher Education Coordinating Board.

Not every institution participating in Houston GPS is operating at the same level; others are further along than their peers in launching the initiative. Sugar said competition between the institutions has helped create less resistance to change. Administrators at one college, for instance, were embarrassed that they weren't further along in using corequisite remediation, which places students in college math and English courses with addition-al supports, after seeing the results from a peer institution, he said.

"That soft accountability advances the work," he said.

The colleges are not just sharing ideas and programs, they're also sharing data; eight of 11 of the Houston GPS institutions are using the same EAB software.

"It was important for us to share data across sectors, across community colleges, universities and governing boards," Short said. "That's almost unheard-of."

The Houston area is also incredibly diverse, with the region ranking as the fifth most diverse metro area in the country according to a Bloomberg analysis of 2010 and 2016 Census data. Sugar and Short believe the work the colleges are doing with Houston GPS will have an impact on closing equity gaps between white and underrepresented minority students.

"When we succeed in Houston -- and we will -- we will have achieved a great outcome in furtherance of equity and social mobility in America, because that's the nature of Houston," Sugar said. "These are urban institutions predominantly serving students from underrepresented populations. Many don't make it to graduation day. Many are first generation. If you want to see America of the future, look to Houston today." ∎

https://www.insidehighered.com/news/2018/08/07/houston-colleges-and-universities-team-boost-student-success

How Portland State University accelerates student degree completion through machine learning

Portland State University (PSU) is using machine learning (ML) to help students find the most effective pathways to graduation. By tracking the course history of successful graduates and presenting recommendations to current students, PSU can provide guardrails and best practices for a focused journey towards degree completion.

With the emergence of massive open online courses (MOOCs), Nano degrees, and online programs, innovative higher education institutions such as PSU are evolving to meet the changing demands of students and deliver more value to compete with peer institutions.

A priority for PSU is to become a data-driven institution to facilitate development across the university and improve student outcomes. PSU is working to help students reach their seducational goals faster. According to the National Center for Education Statistics, only 60 percent of college students receive a degree within six years. PSU is looking to change that for its students by using ML as part of their efforts to improve student success.

To start, the PSU team tackled the challenge of making sure students registered for classes that aligned to their degree goal. Students often have difficulty navigating course offerings to decide which courses will lead to successful completion of their declared major. Taking additional courses outside of a student's declared path can be disruptive to the graduation timeline and lead to attrition. To help deliver value and facilitate student success, PSU wanted to provide students with proven pathways to complete their degree requirements while also enabling the university to plan for its future, including course and staffing requirements. Secondly, this initiative served to strengthen the university's competency with data science to help address additional projects over time.

The PSU and AWS Professional Services (AWS ProServe) team developed ML models to enable the following:

Using transfer students' course histories to predict the best alignment for degree plans. The PSU student body has a high percentage of students who transfer (50 percent) from other schools. The team developed an ML model from historical student data with the intent of informing transfer students of the quickest path forward and suggested majors based on their prior course work. This model simplifies the task of searching through the catalogue to find the right match of courses for each major's requirements.

Alerting students when they choose courses that deviate from their degree plan. This model calculates whether the course selection deviates from the usual range of courses taken by students who successfully completed that degree.

Assisting in capacity planning based on the paths of students currently enrolled. The predictor model is applied to a cohort of students in any particular year to predict the number of students (both declared and non-declared majors) in future years to better estimate the number of students in each major to help with resource planning.

Modeling challenges

As with most ML projects, the team worked through steps to understand and prepare the data for training the models. Due to the volume of inbound student transfers, there was diversity in the paths leading towards a degree and models based on diverse datasets lose predictive power. However, by identifying majors that had meaningful correlations across introductory courses, the algorithm was able to suggest likely majors with reasonable accuracy. Another issue arose as the models identified certain majors where few students completed the degree plan, which resulted in models with an innate bias against these majors. Future work and modeling will be required to address this issue.

The team discovered a sufficient number of these unusual cases and recommended that a human advisor be in the loop to guide student decisions. Although there are long-term aspirations to share the recommendations with students directly, the most effective application currently will be through academic advisors.

> *"PSU's commitment to putting students first demands that we employ the best information to ensure that we are using our resources most effectively in supporting students to achieve their educational goals. We're really excited to test how ML can be an active component of that information landscape,"* said Susan Jeffords, provost and vice president for academic affairs, PSU.

Moving forward

The PSU team plans to build on this project to implement improvements such as incorporating student success data and potentially incorporating information on graduates. They plan to make alerts and reports for students available to academic advisors to increase their effectiveness in helping students make strategic decisions. The guided pathways model will give advisors a new source of information highlighting when students select courses that are outside their best track towards their declared major and may then contact the students to influence a successful outcome.

Customer learnings

An important consideration discussed with PSU was whether to include student success within their choices for majors. Available data included grades in classes, which could be included to improve suggestions of courses, such as the best order to take certain required classes. In addition, this data could help suggest courses that may not be in the major requirements but could assist certain students to be successful in future courses. This type of information is available to students at a high-level, but a prediction ML model could automate the process of using this data to help students make informed decisions.

To learn more about PSU's story, listen to the AWS Fix This podcast episode, *Keeping students on the right track*. To engage with AWS ProServe, visit the AWS Professional Services webpage, and view the machine learning service page to see other examples of how customers are using this unique technology.

Consolidation and Completion Gains

Merger between a low-performing community college and a nearby university has increased graduation and transfer rates -- and could be a model for other colleges.

By Ashley A. Smith // February 20, 2019

Three years ago the University System of Georgia tried to improve single-digit graduation rates at Georgia Perimeter College by merging the two-year college with its Atlanta-area neighbor, Georgia State University.

Georgia State had been praised widely for improving its completion rates and closing equity gaps, and state leaders hoped that success would translate to the community college.

The merger decision appears to have paid off. Georgia Perimeter, which had a 6.5 percent graduation rate in 2014, increased that three-year rate to nearly 15 percent last year. Its completion rates, which measure graduation and transfers to four-year institutions, increased from 41 percent to 58 percent during that same time period.

Gaps in academic achievement between students of color and low-income students and their white and wealthier peers also have closed at the college, which is now called Perimeter College at Georgia State University. As of last year, graduation rates for white, Hispanic and low-income students are roughly the same. The 12-percent graduation rate for black students still trails the 15 percent rate for white students. But both rates have increased since 2014, when they stood at 10 percent for white students and 4 percent for black students.
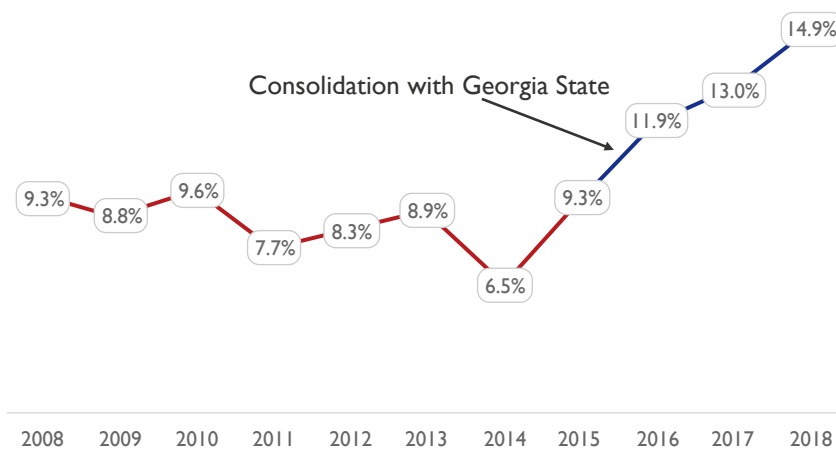
"We've seen rapid progress in retention and graduation rates," said Timothy Renick, Georgia State's senior vice president for student success. "It has been better than we thought it would be in a relatively short period of time."

The college has made other gains in student achievement. For example, more students are staying at Perimeter beyond one year. Year-to-year retention rates increased from 58 percent in 2014 to 70 percent last year, according to data from the institution.

Georgia State officials cite the

Perimeter College Three Year Graduation Rates

Consolidation with Georgia State

Year	Rate
2008	9.3%
2009	8.8%
2010	9.6%
2011	7.7%
2012	8.3%
2013	8.9%
2014	6.5%
2015	9.3%
2016	11.9%
2017	13.0%
2018	14.9%

Perimeter College Graduation Rates by Population: Associate Students
Pre- and Post-Consolidation

	2014	2015	2016	2017	2018
3-Year Graduation Rate	**7%**	**9%**	**12%**	**13%**	**15%**
3-Year: African American	4%	7%	10%	10%	12%
3-Year: White	10%	11%	13%	16%	15%
3-Year: Hispanic	6%	11%	13%	13%	15%
3-Year: Pell	5%	8%	10%	11%	15%

introduction of predictive analytics for helping to increase academic achievement at the two-year institution. The university has become a national leader in using predictive analytics to review hundreds of risk factors for students and to alert advisers when students get poor grades or are on the verge of dropping out. Officials at the four-year institution replicated that system for the Perimeter campuses.

Consolidating Perimeter, which enrolls roughly 20,000 students, and Georgia State, with approximately 50,000 students, saved about $8 million in administrative expenses for the two-year college. The merged colleges no longer needed two presidents, two vice provosts or two English department chairs, for example, Renick said. Georgia State took $3 million of that savings and used it to boost student services and to hire additional financial aid counselors and advisers.

By hiring 30 advisers, Perimeter went from 1,000 students per adviser to 400 per adviser. And students are using the service more often.

"When we took over Perimeter College back in 2015-16, there were about 3,000 students sitting down and meeting with academic advisers over the course of a year," Renick said. "This past year over 50,000 one-on-one meetings have occurred between Perimeter students and academic advisers."

Before the merger, students typically would meet with an adviser when they felt there was a problem. Now, with predictive analytics, the college is more proactive and prompts students to talk with an adviser if, for example, they register for a class that doesn't match their degree program or if they're failing assignments in a math course.

Another intriguing aspect of the merger is the more seamless transfer process between the university and the two-year institution, said Josh Wyner, executive director of the College Excellence Program at the Aspen Institute.

"It's something we all should be paying attention to, because the majority of community college students want to transfer and get a bachelor's degree," Wyner said. "The four-year transfer rate is hugely important. They've gone from below the national average to about the national average. Those are impressive data."

About 80 percent of entering community college students say they want to earn at least bachelor's degree, but only 33 percent transfer to a four-year institution within six years, according to the Community College Research Center at Columbia University's Teachers College.

For Perimeter graduates and transfer students, the merger also has had a positive effect on the public's perception of the two-year college.

"Seeing 'Georgia State' on a transcript will get more attention than just seeing 'Georgia Perimeter,'" said Lee Brewer Jones, an English and humanities professor at Perimeter, who has taught at the community college since 1992. "Just by being affiliated with a [research] institution, even though we're not an R-1 college, it has an impact on how people view our students."

Similar Demographics

Georgia State and Perimeter enroll students with some similarities. More than 70 percent of students at both institutions are nonwhite, and 60 percent are low income. But students at the two institutions also tend to have different needs.

For example, about a third of students at Perimeter, an open-admissions college, need remedial math, reading or English. Georgia State converted all remedial classes at Perimeter to the corequisite model, which allows students to take college-level course work but also receive additional support such as tutoring.

Similarities in student demographics have helped Georgia State better understand how to help Perimeter students.

For example, the university expanded its microgrants to Perimeter students in 2016. The program helps cover unmet tuition and fees for students who would otherwise be dropped because of

nonpayment. The university gives about 300 microgrants per semester to Perimeter students, averaging $900 each.

The university also introduced learning communities to Perimeter, requiring all incoming freshmen to participate last year. The communities allow groups of about 25 students in the same degree program to take a few courses together. The expectation is that the communities help students establish friendships, form study groups and build peer networks.

Academic outcomes have improved for students who participate in the communities. They earn more credits and are retained at a slightly higher rate. And first-year students in learning communities earned on average a 3.18 grade point average compared to 3.09 GPA for those students not in a community.

Jones said many of the concerns Perimeter faculty had about the merger when it was first announced never occurred, such as a mandate for professors to have terminal or doctoral degrees.

And he and his peers have become more focused on encouraging students to earn their two-year degrees, even if they plan to transfer.

"I tell students, 'I hope you take time to get an associate degree before you transfer,'" Jones said. "I don't know if I always thought to say that before, but I make a point of saying, 'Get your associate.' That's an emphasis that comes from the highest levels of the university."

Merging Community Colleges

Georgia isn't the only state to merge community colleges in recent years. Significant enrollment declines and budget pressures have forced other institutions to consider consolidating. For exam-

> The four-year transfer rate is hugely important. They've gone from below the national average to about the national average. Those are impressive data.

ple, the University of Wisconsin System started merging the state's 13 public two-year campuses with seven of its four-year universities last year. And the Connecticut State Colleges and Universities system had considered merging the state's 12 community colleges, but that plan was killed last year by the system's accrediting agency.

Ricardo Azziz, the chief officer of academic health and hospital affairs at the State University of New York System, was president of Georgia Health Sciences University when it merged with Augusta State University to create Georgia Regents University. That institution is now known as Augusta University. Azziz said more colleges and states will consider these types of mergers in the future.

"There are a number of trends driving this, and one is a need for continuing education or lifelong education," he said. "The second driver is pure demographics. The number of students in community colleges is decreasing. The number of high school graduates is decreasing, and the economy is improving."

Even if the economy declines,

he said it wouldn't dramatically increase enrollment at community colleges.

Some researchers have been warning community colleges that enrollment is expected to plummet by 2025. Enrollment in the two-year sector has already been on a decline since around 2010. And last fall, community college enrollment was down 3.2 percent from the previous year, according to the National Student Clearinghouse Research Center.

Mergers between community colleges and four-year institutions tend to be more successful when they are in the same geographic region but don't physically combine, experts say. They also are more successful when the community college retains its open-admissions policy, continues to offer noncredit programs and serves the community's work-force needs.

"Part of the reason why Perimeter and Georgia State have done better is that they're still at separate locations," Azziz said. "The community college structure is still physically different."

But mergers between two dif-

ferent types of institutions can be tricky. The missions and cultures of two-year or technical colleges are different from those of four-year colleges or research universities, Azziz said.

Faculty and staff initially were concerned about merging the two Atlanta-area institutions. Jones said Perimeter faculty worried that the smaller college would be taken over by the university and become a low priority to the larger institution.

"We have retained the autonomy and academic freedom that we had before the merger," Jones said.

Mergers can bring a lot of good to the institutions involved, Azziz said. But they are still complicated and difficult.

"We need to recognize that while a lot of good things can come out

of them and some mergers have been quite successful, the reality is they are difficult things to do,"

"We need to recognize that while a lot of good things can come out of them and some mergers have been quite successful, the reality is they are difficult things to do.

he said. "They have to be thought out, managed well and have strong government support." ∎

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VIEWS

What Data Can -- and Can't Yet -- Tell Us

In the wake of COVID-19, demand for student success analytics has risen significantly, but there is no easy button to finding the through line from information to action, Darren Catalano writes.

By Darren Catalano // August 6, 2020

When my twin brother, a commercial pilot, flies a plane, he knows sensors informed by tens of thousands of prior flights are equipped to predict engine failures. But that kind of sensor data and machine learning doesn't exist for human areas, such as student success. Data and predictive analytics can only foretell so much about which students are likeliest to stumble and why, because human behavior is complex and unpredictable.

Posing the question of how colleges and universities can best help students succeed comes at a crossroads for higher education. When I went to college in the 1990s, my classmates and I were expected to succeed. If something extracurricular held us back, professors and administrators expected us to resolve it before arriving, punctually, to class ready to learn. Many thought it was part of the experience to weed out unsuccessful students. Those who made it were thought to do so for their sheer will, grit and skill.

Even before COVID-19, higher education institutions had shifted the pendulum, so students and universities now share the onus of success. We aim to help rather than consider a struggling student's falloff to be natural selection. To that end, many institutions are investing in new approaches, including professionalized advising, expanded career services and innovations in teaching and learning. They're modernizing systems, adopting new technologies and looking to data to provide answers about how to more effectively and efficiently support student success.

This work is challenging during the best of times, let alone in a post-pandemic environment. But today's complicated climate has institutions turning to student success analytics more than ever. An Educause Quick Poll conducted in late May found that since the transition to emergency remote teaching, demand for student success analytics has increased at 66 percent of surveyed institutions.

Unfortunately, this is not an easy, on-demand endeavor. When thinking about what data can tell us about student success, it helps to first understand the data landscape and what data exist and do not exist ... yet.

Already captured and easily available. Colleges and universities already collect and can access a variety of data relevant to student success. That includes data related to prior academic work, current academic performance and financial need. While the data have limitations, they are the place to start.

Already captured, but not easily available. Relevant data live in systems across campus but are more difficult to surface, share and use for student success purposes. Student affairs and student engagement data are good examples. While they are collected, they are harder to access. But by mak-
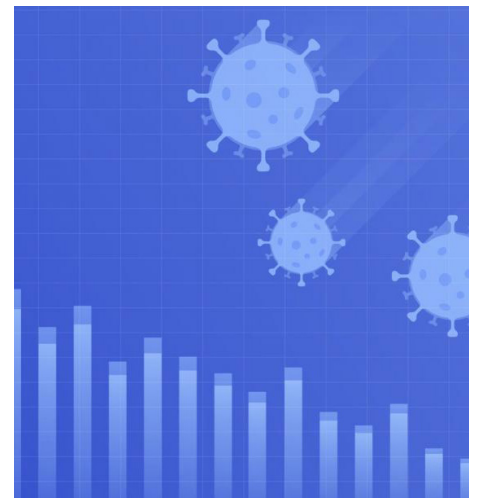
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ing them available, institutions can add a layer of sophistication to understanding student success. For example, by integrating learning management system and learning data, institutions can understand how students are responding to remote and online learning. Or by merging facilities and course registration data, they can better understand how to schedule classes and be compliant with social distancing guidelines.

Not yet captured and not easily available. This is where institutions really have a greenfield opportunity to meaningfully impact student success, but the degree of difficulty is high, because institutions do not yet have systems or procedures in place to collect and access this data. Most often, such data are surfaced through intentional interactions, for example, with academic advisers and residential life staff.

This gets at mind-set, concerns, career aspirations and the like. Are students having trouble with housing or their roommates? Are family finances causing additional stress and distracting them from their studies? Are they struggling to adjust to the new realities of life and learning in the era of COVID-19? Was their internship canceled or will they be unable to complete their practicum? All could have a significant impact on student success, but few institutions have mechanisms to know this very human information, let alone act on it. These are blind spots.

By taking this view on data, an action plan emerges. Colleges can begin by focusing on the data that are easily available while understanding their limitations. They can gain greater insights by expanding data sets to include data that can be extracted from all relevant systems. They can start to eliminate blind spots by establishing new systems and procedures to capture more individualized data that the various people involved in student success across the campus can provide.

Once colleges and universities have collected all available data, they can create models and assign weights to understand which are primary versus secondary variables. For example, students' financial needs for paying for college might be the primary concern when it comes to student success, making their academic performance secondary. Students may have good grades, but if they can't afford to attend the institution, they will not persist. Along the way, institutions need to include as many data points as possible to mitigate blind spots, and that data can help with a range of actionable analyses, such as financial aid optimiza-

> **The key to all data-driven student success efforts is to remember that students are people first.**

tion and course sequencing.

Remember the Human Element

The key to all data-driven student success efforts is to remember that students are people first. In my former role as vice president of analytics at the University of Maryland Global Campus, we found that the most effective intervention sent to students was a simple, empathetic message asking them, "How are you?" That open-ended intervention, rather than a prescriptive one, like "We noticed you didn't read the syllabus before class," elicited the most positive student responses. It was primarily a human question, which is why it was so well received.

Not only must colleges and universities remember the human element when applying data to support student success, but they must also do so when they capture and assess that data. It is vital to respect student rights and privacy. There's good cause to be on high alert about improper data collection and analysis these days. Institutions should strive to be the gold standard for responsible and sensitive data use and articu-

late clearly the purpose of the data being collected and how they are being used to support students.

This is especially important today as institutions grapple with COVID reporting and the need to balance student rights and privacy with public health concerns. If you have to collect data for contact tracking and tracing, be very explicit about the limited use cases for when you will use it, as well as shared responsibilities. Some institutions have begun to ask students to sign pledges that describe guidelines and obligations to fellow students and the university if they get sick. This kind of transparency and joint accountability is key.

We also need to be humble about what data can and cannot do. When wielded correctly, it can help us do just about everything better, but it is not an easy button to press that magically fixes everything.

The final caveat here relates to scale. Even if your initiative is successful, you should expect incremental results and that getting results will take time. You're not going to make one tweak here and see a

10-percentage-point increase in retention next year. That outcome would be unheard-of, and even the best predictive models don't perform miracles. As much as we wish for one, there are no quick fixes.

Ultimately, the goal should be getting to where your institution is able to use data from across campus -- including more-difficult-to-capture data -- to better understand students and how to best support their success. But even as colleges and universities strive to build out these capabilities, they can still make an impact right now with data that they can already access. If we wait, we don't just lose time until we see the benefits of data, we lose students. The key is to get started and use whatever data are available to help the students we can today while expanding efforts to help even more tomorrow. ∎

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We also need to be humble about what data can and cannot do. When wielded correctly, it can help us do just about everything better, but it is not an easy button to press that magically fixes everything.

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Bio

Darren Catalano is the former vice president of analytics at the University of Maryland Global Campus. He currently serves as CEO of HelioCampus, a data analytics company born out of the University of Maryland system that helps colleges and universities use data analysis, data storytelling and data science to inform decision making across all areas of campus.

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aws is how

Still Not Using Data to Inform Decisions and Policy

Has your institution increased its investments in analytics in recent years? How's that working out for you? Two recent surveys suggest that for many institutions, the investment is not working out very well, Kenneth (Casey) Green says.

By Kenneth C. Green // February 25, 2020

digitaltweed

The past decade has seen increased campus discussions about and investments in analytics. Prompted in part by the activities in the consumer and corporate sectors, institutional leaders up and down the campus organization chart are increasingly engaged in conversations about leveraging data and analytic tools to inform institutional planning and policy making, enhance student learning, improve retention and graduation rates, and improve campus operations and services.

Fueling the campus conversations (and expectations) about analytics are the accelerating external pressures for improved institutional performance (e.g., student success and graduation), as well the presentations (and promises!) of technology and analytics providers. The various firms that provide administrative/ERP systems and LMS applications have increased their efforts to promote analytic resources to their campus clients. Too, we've also seen the emergence of a new category of "ana-

lytic middleware providers" -- firms that promise to provide programmatic solutions that emerge from their "special analysis" of student and institutional data drawn from a variety of core but often incompatible data resources that contribute to "data babel" at many institutions.

Admittedly, there are some impressive success stories from campuses that have invested in analytics. Perhaps the most striking involves Georgia State University, which has effectively eliminated the historical (and significant) differences in retention and graduation rates among its various student populations. As reported by *The New York Times* in 2018, the university "reshaped itself amid a moral awakening and a raft of data-driven experimentation." Over a decade, the graduation rate for all GSU undergraduates increased an impressive 23 percentage points, rising to 55 percent in 2018. Particularly impressive is that baccalaureate completion rate for African

American men is now 55 percent, up from 18 percent in 2003.

Another example of analytics, this one focused on gateway courses, comes from the John N. Gardner Institute for Excellence in Undergraduate Education. As described in a recent *Chronicle of Higher Education* article, the institute works with client campuses to analyze data and implement evidence-based redesign initiatives for key gateway courses as part of campus efforts to reduce DFWI rates and improve retention among first-year students. Preliminary data from 13 campuses working with the institute "shows higher grades, pass rates, and retention rates among students in revamped courses compared with students in course sections that did not go through the reform process" according to Gardner Institute president Drew Koch.

Admittedly, there are also other impressive examples where analytics has helped inform planning, programs and policies, leading to major gains in retention and grad-

uation rates across student demographic group.

And yet despite these emerging and well-documented success stories about using data and analytics to improve academic programs and services and to inform planning and decision making, two recent surveys point to analytic angst among CIOs and CAOs. By analytic angst, I mean that despite the rising institutional investment in analytics, only a small proportion of senior campus officials assess their campus investments in analytics as "very effective" or report that their institution does a "very effective" job of "using data to aid and inform campus decision making."

Let's begin with senior campus IT officers and data from the fall 2019 Campus Computing Survey. While three-fifths (60 percent) of the surveyed CIOs and senior campus IT officials identified data analytics as a "very important" institutional priority, less than a fourth (22 percent) assessed their institution's IT investment in analytics as "very effective." The proportion of IT officers assessing their institution's investment in analytics has hovered around 20 percent for the past five years. In contrast, in 2019 half the survey participants (48 percent) rated the campus IT investment in on-campus teaching and instruction as "very effective," and just over two-fifths (44 percent) offered a similar assessment about IT investments to support library resources and services.

Turning to provosts and chief academic officers, *Inside Higher Ed*'s January 2020 CAO survey also offers some striking data about the institutional inability to use data to aid and inform institutional decision making. Just a fourth (23

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percent) of the surveyed CAOs assessed their institution as "very effective" in "using data to aid and inform campus decision making." Moreover, the CAO number has plunged over the past eight years, from 31 percent in 2012 to 23 percent in 2020.

Despite rising institutional investments over the past decade, these data provide a candid -- and clearly disappointing -- assessment of the impact of analytics at many campuses.

The key question is why the low numbers from CAOs and CIOs on the impact of analytics and campus efforts to make effective use of data for planning and decision making?

The answer, I believe, is actually found in the examples from Georgia State, the Gardner Institute and some other institutions that have launched successful analytic initiatives. These efforts have been successful because they have looked beyond the numbers to develop and invest in programmatic efforts that transform data into information, insight and innovative initiatives.

Yes, 'tis true that the intense and well-designed analytic work at Georgia State identified some 800 separate factors that could affect academic progress and student success. But while the "top-level" summaries of the Georgia State story have often focused on analytics, essential to the university's improved graduation numbers was the addition of some 180 academic support personnel to work with at-risk students. More than just receiving an automatic, analytics-driven (and potentially stigmatizing) email informing a student that he or she might be at risk based on a range of metrics and behaviors, that email also provided a path out to connect the individual student with academic advisers and critical support services.

Similarly, the Gardner Institute's work draws on analytics to develop a "morning-after" strategy focused on course redesign: the emphasis is not on the numbers, but on using data to inform and improve gateway courses, leading to higher completion rates and lower DFWI numbers.

In other words, analytics only work if the analytic work is part of a larger and well-understood gestalt: the sum (improved student outcomes) is more than the parts (analytics and other unconnected efforts). Absent an institutional (or departmental) commitment to evidence-based, well-designed and well-resourced intervention strategies and support services, the investment in analytics is almost certain to fall short of expectations.

Too, part of the new conversation about analytics is that we must change the data culture in higher education. For too long data have been used as a weapon to document what was done wrong or why an initiative failed. Rather than using data as a weapon, we must (like Georgia State) use data as a resource, focusing on how we can -- *and will* -- do better.

And a key part of the new "data as a resource" strategy requires that we plan for assessment as we develop new programs and initiatives, not as a post-hoc afterthought. We must build in the plans for useful data and appropriate assessment as part of program design, rather than scrambling for data to support assessment after programs are launched.

Like many others, I have long argued that campus planning and policy discussions must migrate from opinion and epiphany to data and evidence. My hope is that the CAO and CIO data cited here suggest the bottom of the curve and not the continuing state of affairs.

We can -- and must -- do better.

Disclosure: I am an unpaid fellow of the John N. Gardner Institute.

Additional References

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Read Original Article ▸▸   https://www.insidehighered.com/blogs/digital-tweed/still-not-using-data-inform-decisions-and-policy

A New Data-Driven Ecosystem

❚ Moving from traditional assumptions to evaluated best practices.

By Peter Smith // August 5, 2020

We all are familiar with the notion of the educational ladder. Most of us grew up with it. Beginning with preschool (for some), through kindergarten and elementary school to middle and high school. And then on to college (for some) with a sequence of certificates and degrees up through postdoctoral work.

Finishing one stage has always been the required qualification to begin the next. And each stage had a beginning, a middle and an end. It was up to the learner to adjust to the costs, the sequences, their rules and definitions of participation and success, and their determination of just what acceptable levels of knowledge were. While this necessarily brief and over-generalized description applies to American higher education since the founding of our first colleges, it is especially pertinent in describing the evolution of the entire system since 1950.

To put it bluntly, the ways that we have offered higher education spring from inherent historical assumptions that dictated who could learn, where, what would be taught, what knowledge was appropriate for academic standing and how the knowledge would be shared and evaluated. In the last 50 years, we have pushed on those assumptions, welcoming more people in more modes of participation. But the basic assumptions have not changed. The traditional campus-based model is largely assumption driven.

This is the system and the sequence that is being disrupted as I write. And the driver for that disruption is a new, data-driven ecosystem of learning that can identify best practices, those which produce greater retention, more success, more focus on what needs to be learned and why, and higher levels of learning completion for all populations.

We are moving from assumption-driven practices to evaluated and data-driven practices. This disruptive change allows learners with vastly different backgrounds and needs to receive more respect for their talent and experience and also to assume greater participation in educational decisions that affect them. The new ecosystem and the data it generates gives us the potential and the tools to erase systemic discrimination from the educational blotter. Whether it has been intentional is not, in my opinion, the important point at this time.

It is important, however, to recognize that assumptions are discriminatory. They inherently favor some people and circumstances over others. Assumptions dictate winners and losers, while good data tell us which practices work better, producing more positive results, and which do not. The move from assumptions to data-driven best practices is the key to ending systemic discrimination in postsecondary education.

In the blog posts that follow, I will attempt to describe the steps in a basic learning cycle and how data-driven practices in the new ecosystem can drive better outcomes for all involved, thus significantly reducing and hopefully eliminating systemic discrimination in all its forms. ∎

Higher Ed Leadership and Ed Tech in the 21st Century

Innovations and advances raise questions of how new academic leaders should help choose the best products and develop the best practices, writes Terri E. Givens.

By Terri E. Givens // June 20, 2019

Software and technology have been a part of higher education since the first computers came online. Despite this, many new academic leaders have much to learn about the latest developments in the world of ed tech. Advances in software and new apps raise questions of how leaders should choose the best products, as well as how best practices can be developed.

The world of educational technology was mainly focused on learning management systems when I started my academic career in the late 1990s. Blackboard was new, and soon we would see new entries such as Canvas and Moodle. Then, when I joined the provost's office at University of Texas at Austin in 2006, it was clear that the campus was going to need a new student information system -- the mainframe version was getting outdated. The efforts to develop data-gathering systems for faculty went through several fits and starts. I recall trying out one of the beta systems that allowed me to put all of the information for my annual review into an online form. But that initial system was abandoned when it didn't work properly, so my efforts were in vain.

When I became provost at Menlo College in 2015, one of my goals was to learn more about the ecosystem of educational technology in Silicon Valley. Also, as a board member for several organizations that support college-bound students from underserved communities, I became interested in the ways that companies were using educational technology to help first-generation and low-income students succeed in college.

At Menlo, the first step for me was getting a better understanding of the software systems and apps that we used across the campus. I knew that we used one system to gather our student information and another as our customer relations manager for admissions. We were also in the process of adding another data management system for our alumni and donors. The transfer of data from each of these systems could be complicated by data entry errors, and keeping track of the status of students often ran into issues. I also soon learned that there wasn't a good solution that covered all three components of a student's passage through the college, and even if there were, it could be prohibitively expensive to try and migrate to a new system.

The imperatives of a changing student body led the college to try various apps for student engagement, particularly those that would work on mobile phones. It was clear that students were rarely reading email and that getting important information to them would require using text messaging. Our student affairs division tried several apps that would not only send important messages but also track student use of services such as advising, the career center and attendance at campus events. Campus security was also a factor, as the need arose to be able to reach stu-

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dents in case of emergency, such as a natural disaster or security threat.

Using Technology to Improve Student Outcomes

Since I left my position as provost last summer, I have been working with several ed-tech companies and attending conferences that emphasize ed tech, such as ASU/GSV or those focused on a tech topic, like one at *Inside Higher Ed*. Most recently, I started my own company, the Center for Higher Education Leadership, which has a mission of empowering leaders and providing a portal for professional development opportunities. Although we provide support for a broad range of administrative issues, information on the latest in ed tech is an important component of our professional development offerings.

I have become interested in ap-

plications that use artificial intelligence to try to improve student outcomes. Several apps are available that can send students text messages with reminders or ideas for improving their class performance. This includes Study Tree, which started off as a way to connect students with peer tutoring and has evolved into a broader approach to student success -- one that helps with studying and access to complementary resources for courses.

About a year ago, I was invited to an event at the Salesforce.org headquarters in San Francisco, and I also attended their Higher Education Summit in Washington, D.C., where student success was a major theme. I learned about the ways that other universities, like Georgetown University, were using technology to reach students in a variety of ways. And I became aware of companies like Civitas that use predictive analytics to track student progress and improve student outcomes.

The use of data to track and support students has raised some concerns about student privacy and tracking of students in ways that might negatively impact lower-income students. However, it was also clear that these types of data could be used to improve graduation rates, if used properly.

Such concerns led, in fact, to the collaboration among several large research institutions through the University Innovation Alliance. The universities, including my former employer, the University of Texas at Austin, share best practices for using predictive analytics to improve student success, with a focus on improving graduation rates. For example, former University of Texas senior vice provost David Laude, who had been

> ## Using data to track and support students raises privacy concerns but also can help improve graduation rates, if used properly.

charged with improving graduation rates, encouraged the use of predictive analytics and also developed new practices in his own biology courses that improved student retention. He focused on helping students complete those courses rather than using the big lecture classes to weed out less prepared students.

But before they could move forward with their ambitious agenda, members of the alliance found that they had to go back to their institutions and determine what data resources already existed and develop an inventory of data and processes. Similar to my experience at Menlo College, it was important for campus leaders to gain a better understanding of how different units on campus were using data and software, from admissions to student life to alumni outreach. All of the campuses involved have achieved improvements in graduation rates, but the progress has perhaps been slower than expected.

Laude and other representatives from the UIA presented their results at a leadership forum held at the recent ASU/GSV conference. Many organizations such as *Inside Higher Ed* are working to bring higher ed leaders together to learn more about the best practices around student success that are happening at places like ASU, Georgia Tech and the University of Texas at Austin. But more outreach needs to be done, and I'm hoping that my own platform and others will be the means of sharing best practices, not only for four-year institutions but also community colleges.

Collaboration can be difficult, even within college campuses, given the varying needs represented by all the academic and administrative units and the demands of accreditation. The burgeoning world of educational technology is working to address many of the issues that college campuses face, but the results are often piecemeal approaches to different aspects of a student's journey from high school student to alum. It is important to break down the silos across a campus so that institutional leaders can understand the current use of technology, develop plans for collaboration, reduce the redundant use of software and develop a technology strategy that can reduce costs and increase in-

novation. Meetings of key stakeholders are a vital component to developing these strategies, but it will have to be guided by top leaders and chief information officers who have a handle on the broader tech landscape.

Another takeaway for me has been that higher education leaders and those in the ed-tech world need to work to understand and communicate more with each other. This process must start with education. New higher ed leaders need to take the time to learn about the tech landscape and gain a better understanding of the variety of offerings available. Attending conferences like ASU/GSV or Educause is a good introduction to the world of educational technology and will provide new campus leaders with a quick introduction to the variety of offerings that can help their campuses support students and improve their infrastructure. Our newsletter, Higher Ed Connects, is an additional resource for those who cannot make it to a conference or want the latest on ed-tech issues for administrators.

K-12 and higher education institutions must also collaborate more on these fronts. That could

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be done through creating more connections between high school representatives who are advising college-bound students and college academic advisers. Finding ways to share information could help students have an easier transition from high school to college. This could be done through existing organizations like NACAC and NACADA, who bring together professionals who work with students in college admissions and advising.

The stakes are high as we work to improve access and provide support for students so they can be successful in college and in their

careers. Higher education is an important gateway to jobs that will evolve as technology like AI continues to reshape the working world. As I watch my own son enter college, I hope he will benefit from a liberal arts education that takes advantage of the latest innovations, providing him with a strong background for whatever career he may choose. That includes the latest innovations in educational technology. This is an evolving topic, and I will continue exploring in future articles the ways that campuses across the country are addressing it. ∎

Bio
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Machine Learning, Big Data and the Future of Higher Ed

These new technologies have much to offer colleges and their students, but if we are not careful how we incorporate them, the risks may outweigh the gains, Vincent Del Casino Jr. writes.

By Vincent Del Casino Jr. // March 21, 2018

If you ask, many people will say we are in a new era of higher education, one where machine learning and big data analytics are driving rapid change. From the influx of adaptive learning technologies to the automated student support services and predictive analytics models driving new interventions, there are fewer spaces of college and university life that are not being touched by these technological innovations.

These technological opportunities could offer a lot to higher education. Indeed, if we ignore the opportunities that machine learning and big data analytics might provide to complement our human capacities, we will do a disservice to those we claim to serve -- our students.

But if we treat them as an opportunity to downsize the work force or largely replace human social interactions with automated ones, we are going to lose a lot more than we gain. Herein lies the dilemma. What is the balance?

Given this time of turbulent change, I want to offer some reflection on the future of higher education in the age of machine learning and big data analytics. I do so in the context of what these technological opportunities may provide and how higher education has to manage its relationships to those technologies across three key areas: teaching and learning, predictive analytics, and student support.

In the age of machine learning and big data analytics, higher edu-

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cation is being offered the opportunity to personalize its education through adaptive learning technologies. As the machines get smarter, so too do the adaptive learning algorithms that can respond to students. This is not, of course, a wholesale swap-out of faculty-led teaching for machine-driven learning. It is way too early for that world.

But the adaptive learning movement -- driven by a growing for-profit educational technologies industry -- should produce a moment of pause for higher education. The promise underneath these technologies is the notion of a hyperindividualism whereby each person can collect up skills and credentials with less and less social interaction. In fact, adaptive learning technologies, while not being built right now to take the place of everyday teaching and learning, can feed into a prevailing mind-set that

continues to call into question the value of higher education, the role of the university and college, and the teaching and learning that take place there.

If we have learned anything from the slew of reports that suggest that fewer and fewer adults see the "real value" of higher education, the ability to bypass the critical thinking work that goes on in the day-to-day world of the university becomes appealing to those who are ideologically opposed to a broad liberal understanding of higher education. Instead of adaptive learning playing the role of supplemental tool -- and a very good one in many cases -- these technologies could be sold off as a cheaper, faster and less contentious road toward a credential that will support advancement in the future work force.

What is lost by this move is the

interstitial work that happens in universities that continue to bundle their education into programs that focus student attention on the interconnections, debates and opportunities provided by thinking across different topics, concepts and ideas.

Technological advancements are also shaping student success and the big data futures promised by predictive analytics. Committed to one of the core values of machine learning is the potential to analyze large sets of data that can be used to focus more intently on the individual learner. No longer will institutions be beholden to crude models that rely on population-level metrics for cohorts of students. Instead, variables can collide in a big data machine and focus attention on the individual student in a much more granular way.

There remains a lot of uncertainty in the big data futures that many companies and universities are promising. Even after the machine learning algorithms provide results, the question of why a certain finding appears can often remain a mystery; it still takes good old-fashioned qualitative work with faculty, staff and students to really understand the answer the machines might be giving us. Machine learning and big data analytics could also push universities to provide solutions to students that might not be in their best interest. Those solutions, if built on a deficit model instead of a growth mind-set approach, might track students into support services or academic enrichment programs that create a sense of isolation from instead of a sense of belonging to the wider campus community.

The caution here is that the machine learning algorithms can only

> **Big data analytics provide a real opportunity to move toward more predictive models and interventions, [but] if universities de-invest ... in the talent to interpret those results and act upon them, they will likely find little value in their long-term value proposition.**

do so much. The "noise" found in what the system is "not telling us" remains just as important as the predictions the algorithms might generate. Practitioners have to interpret the machine learning-based results. If not, universities are going to be driving their strategies toward machine learning-derived outcomes that might not impact student success.

Put another way, while big data analytics provide a real opportunity to move toward more predictive models and interventions, if universities de-invest (or not invest at all!) in the talent to interpret those results and act upon them, they will likely find little value in their long-term value proposition.

Higher education is seeing opportunity produced by machine learning and big data analytics in the space of directed student support. New technologies are emerging that allow students to map their progress toward degree, figure out their next academic step, connect to employers and even build skills that enhance their education along the way. There is real promise in this future, particularly if

these technologies can help institutions scale support in ways that are not tenable in an environment where they have more students and those students are taking advantage of online and hybrid education to diversify their learning experience. Students are simply not in the same place at the same time anymore, and technological interventions can help recreate some of that social loss if managed effectively.

Perhaps, most importantly, machine learning and big data analytics provide higher education the opportunity to unfetter learning from the rote system of knowledge acquisition and take advantage of learning analytics to more deliberately engage students. The challenge of any such system, of course, is the question of to what are you building connections? Is it to the system or to each other? If it is to each other, what are the goals of making those connections and to whom? But a responsive system that can easily direct students to resources can go a long way in helping institutions manage the much more complex future of stu-

dent learning, where students are not arriving in first-time, full-time cohorts to complete a degree 15 units at a time.

I believe there remains a lot of potential in a future of machine learning and big data analytics. But, for it to be realized, higher education may have to either commit to a certain level of privacy invasion -- students will have to volunteer more and more data to refine the models -- or sacrifice certain analytic power to provide students the relative privacy they want to maintain. How universities create systems to both protect privacy and support students will be a challenge as the privacy debate heats up both locally and globally.

Given this and the many other issues outlined above, I am neither an optimist or a pessimist when it comes to the future of higher education in the age of machine learning and big data analytics. I am, however, trying to be realistic and responsive to the potential futures that new education technologies present. In that response,

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I hope that universities pause and reflect on the equally important human capital and social interactions that remain essential to higher education and leverage real opportunities, such as those afforded by open educational resources or collaborative, student-centered virtual learning tools based in the principles of universal design, for example, to create a better learning future.

What this all suggests is that higher education should have a serious and ongoing conversation about how we place machine learning and big data analytics into our institutions and what infrastructures these new technologies demand so that they are responsive to us and not the other way around. ∎

Bio
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