

BIG DATA IN EDUCATION

A RESEARCH REPORT FROM
THE CENTER FOR DIGITAL EDUCATION



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**Harnessing
Data for Better
Educational
Outcomes**

THE CENTER FOR DIGITAL EDUCATION SPECIAL REPORT is a one-of-a-kind publication that provides education leaders with research-rich content that includes perspectives from industry experts and public sector peers. It consolidates current thinking, best practices, tips for successful implementation, professional development guidance and more — all within a single source. We hope you enjoy this current Special Report on Big Data in Education. Don't miss the next Special Report on Personalized Learning coming out this winter! www.centerdigitaled.com/reports



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DATA: THE REAL GAME CHANGER

Today's education increasingly relies on technology. In the past decade, educators and administrators have used student information systems (SISs), learning management systems (LMSs), and enrollment and admissions management systems to optimize and streamline classroom, school and campus operations. More recently, institutions have implemented mobile devices, online assessments, digital curricula, education apps and digital whiteboards to advance teaching and learning.

The real game changer for education, though, is the byproduct of integrating technology into the classroom: data, increasingly referred to as “big data” because of its tremendous volume, variety and speed. As education institutions continue to adopt online learning systems, digital curricula and mobile devices, useful data is generated, which empowers instructors, administrators, curriculum managers, parents and students to make better decisions regarding teaching and learning.

Aggregated and shared across educational systems, this data can provide actionable, macro-level insights that allow institutions and government organizations to link student, educator and school performance, and provide stakeholders — including parents — with insight into student progress. It can have a real-time impact on curriculum structure, instruction delivery and student learning, permitting change and improvement. It can also provide insight into important trends that affect present and future resource needs.

However, in spite of its promise, data does have challenges and risks. It is streaming into education databases and data warehouses faster than it can be managed and controlled, let alone analyzed. Data can only be a game changer when it's mined to provide insights, so institutions must deploy the

appropriate technology systems, techniques and tools that make this possible. They must also ensure student privacy and data security.


While K-12 and higher education have distinct challenges and will use much of their data in different ways, all educators and administrators need a thoughtful plan for leveraging big data in classrooms and on campus. To help education institutions evaluate their needs, resources and goals for big data, this Center for Digital Education (CDE) Special Report will highlight the strategies schools, districts, colleges and universities use for collecting, managing and utilizing data to support learning and instruction and achieve 21st-century education goals. ■



Know the Terms

- ➔ **Big Data:** Traditionally described as high-volume, high-velocity and high-variety information.
- ➔ **Learning or Data Analytics:** The measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs.
- ➔ **Educational Data Mining:** The techniques, tools and research designed for automatically extracting meaning from large repositories of data generated by or related to people's learning activities in educational settings.
- ➔ **Predictive Analytics:** Algorithms that help analysts predict behavior or events based on data.
- ➔ **Predictive Modeling:** The process of creating, testing and validating a model to best predict the probability of an outcome.

WHAT CAN EDUCATION DO WITH BIG DATA?



Dr. Kathleen Reid-Martinez, provost of Oral Roberts University, along with the university CIO Michael Mathews, uses data and analytics to understand and improve student retention rates.

Big data is everywhere. In health care, it's being used to predict epidemics, cure disease, improve quality of life and avoid preventable deaths. Government agencies are using big data analytics to fight fraud, waste and abuse in areas such as Medicaid and unemployment insurance. Public safety departments are employing GIS solutions and data-driven tools to support intelligence-led policing. Political candidates are even using analytics to pinpoint which voters they need to win and tailor campaign talking points to align with a particular voter's interests. The list goes on.

But what can big data do for education? In short, data holds the key for institutions to create better outcomes for students by helping educators understand *why*. *Why* did a student not graduate? *Why* did a student drop or fail a course? *Why* did a student not master a particular concept or skill? If educators can identify red flags around performance and behavior, they can intervene before a poor assessment score results in a student failing a course or not graduating. This predictive capability is critical to intervention and is a cornerstone of effective personalized learning.

CDE conducted a survey to obtain insight into K-12 and higher education leaders' perspectives on big data — including which areas they thought big data would have the greatest impact, their challenges in leveraging big data and their plans for big data in the future.¹ Surveyed educators said the biggest benefits of data and analytics are the ability to analyze, track and predict student performance (69%); improve graduation and retention rates (61%); and adjust teaching strategies for just-in-time intervention (47%).

Judging by these responses, it is clear educators see improving student outcomes as big data's biggest promise. To that end, school districts and higher education institutions are increasingly harnessing ever-more sophisticated technology to slice and dice information to find out what is working and what isn't. But their use of data to improve outcomes doesn't stop there. The following sections highlight some of the innovative ways K-20 campuses are leveraging data.

was at risk of dropping out until the student packed his or her bags and left campus.

But now, both K-12 districts and higher education institutions are identifying data points that raise red flags — sometimes before the students themselves even know they are struggling. For example, Ohio's Sinclair Community College collects data on whether students are using their garage pass, attending advising appointments and meeting with campus tutors.

Data holds the key for institutions to create better outcomes for students by helping educators understand *why*.

Why did a student not graduate? Why did a student drop or fail a course? Why did a student not master a particular concept or skill?

Tracking Student Performance, Ensuring Success

One of the most popular uses of big data in education is the ability to track achievement and identify at-risk students. Traditionally, it has been difficult for education institutions to provide critical and timely intervention simply because they did not know a student was struggling until it was too late. Most assessment data was summative and provided after-the-fact insights. In education, a student's lack of mastery of content and skills may not have become evident until he or she scored poorly on an assessment — and by then the entire class may have moved on to new material. In K-12, summative assessment data on student achievement may not become available until the end of the school year, meaning students who haven't mastered the curriculum are moving on without the appropriate skills. In higher education, where students are much more independent, colleges and universities may not have realized a student

This data is presented on a dashboard to show which students are struggling and at risk of failing or dropping out. Once a student demonstrates signs of losing engagement, Sinclair's system suggests how and when professors should intervene.² Similarly, Oral Roberts University (ORU) in Tulsa, Okla., recently began applying analytics to mine data housed in its cloud-based platform to understand and improve retention rates of its nearly 3,500 students.

"Our administration realized we needed to have more finite, precise and real-time analysis of our persistence and retention rates and improve upon any gaps," says Michael Mathews, CIO of ORU. "Across the entire university and six colleges, we needed to drill down and take a look at the data."

With the data, ORU was able to implement an early warning system and create meaningful views for faculty to understand which students were struggling. In one semester alone, ORU saw its retention rate climb from 61 percent to 75.5 percent just by having accurate information on hand. "We're

not relying on guesswork anymore,” says Mathews. “We have more precise data to work with and more detailed information.”³

K-12 districts, too, are using data to track and report student progress and create visualizations to arm educators with insights about their students. In some cases, these schools are working to predict what students’ needs will be years or even decades down the road. For example, Charlotte-Mecklenburg

Schools in North Carolina uses a scorecard system to anticipate whether its elementary students will be at risk of dropping out of high school.⁴ Data analytics cross-reference grades, attendance, course failures and disciplinary incidents, predicting as early as kindergarten which students are at risk. While many schools are utilizing this general practice, few reach so far into the future.

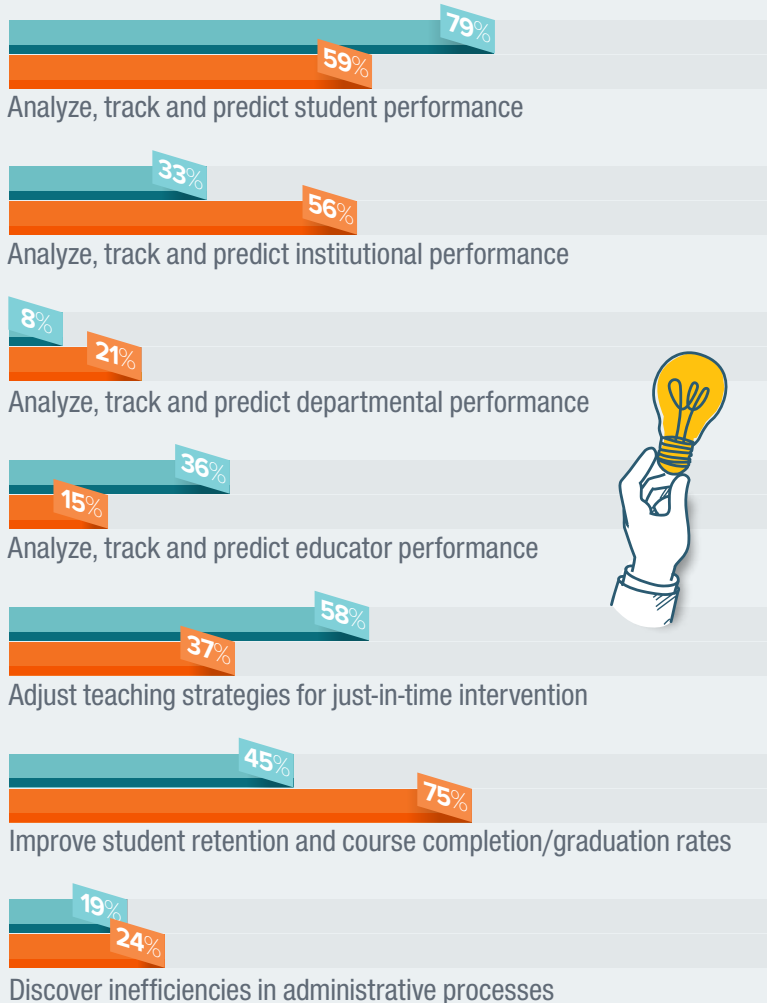
Leora Itzhaki, principal at the district’s Blythe Elementary School, says the scorecards give instructors an indication as to why certain students may be falling behind. The district’s barometer includes the number of times a student has changed schools, the age differential from classmates and whether English is a second language for the student. “The scorecard puts that data out there with the click of a button and makes it really clear,” says Itzhaki. “A lot of this is common sense, but having it grouped together helps teachers work smarter, not harder.”⁵

At Miami Carol City Senior High in Miami Gardens, Fla., red flags include 20 or more days of absence, 2 or more behavior offenses and poor course performance. This data helps the school quickly address the problems behind the numbers. Sometimes students’ academic challenges can be the result of personal issues, including conflicts with parents, food insecurity or even homelessness. The program, called Diplomas Now, identifies 150 to 200 students each year and provides instructor collaboration, teacher-student conversations and resource referrals — interventions that can mean the difference between a student dropping out or graduating with a bright future. As a result, one-third of habitually absent students and two-thirds of students with poor behavior graduated in 2013. Tracy Troy, a teacher at Miami Carol, says, “If we don’t get to the core of the problem, we can’t teach them.”⁶

Ian Mortimer, vice president of enrollment management at Nazareth College in Rochester, N.Y., says his college evaluates patterns in students’ campus experience — including their academic,

What are the benefits of data and analytics in education?

■ K-12
■ Higher Ed



Source: CDE Big Data Survey, 2015

Ian Mortimer, vice president of enrollment management at Nazareth College, believes the use of data ultimately leads to a better understanding of what contributes to student success. “You can find patterns [in the data]. They’re there if you’re willing to spend time combining data points into single variables and then correlating those back.”

residential and social engagements — and compares them with those that are known to lead to satisfaction and persistence. Nazareth uses this data to predict outcomes and intervene if necessary.

“You can find patterns,” says Mortimer.

“They’re there if you’re willing to spend time combining data points into single variables and then correlating those back.” Mortimer, who believes one of the most significant uses of big data by college administrators is improving graduation rates, says the Nazareth College team found several experiential combinations that help explain why some students leave school with a diploma — and why some just leave.⁷

Optimizing Campus Operations, Increasing Efficiency

While improving student success is educators’ top priority with big data, institution leaders also see data as critical for improving operations by increasing efficiency and productivity. According to the previously mentioned CDE survey, 44 percent of respondents said the ability to analyze, track and predict institutional performance was a benefit of big data and 22 percent said big data could help them discover inefficiencies in administrative processes.

Schools aren’t corporations, but they still have business functions to fulfill. Administrative analytics streamline essential business functions and integrate financial, budgeting, personnel and procurement data. This activity helps bridge the divide between the academic and business arms of institutions, helping decision-makers strategize, plan, optimize operations and become nimble enough to respond to trends and new opportunities in a rapidly changing marketplace.

By configuring standard business processes and unburdening IT resources for mission-critical activities in learning, teaching and research, administrators can calculate the true cost of delivering quality education.

One area where analytics can boost operational efficiency for a district or university is in the finance department. Higher education institutions, in particular, can leverage data analytics to manage revenues and operational costs, forecast budgets, set market-competitive tuition rates and grow investment portfolios.

Institutions can also save on utility bills by collecting and analyzing data. For example, Panama-Buena Vista School District (PBVUSD) in southern California implemented software on each of the district’s computers to determine when computers were turned on and when they were no longer in use. The software enables the district to customize individual machines. “I can set when to turn a computer off, or add a special rule ... not to do anything between certain hours, or on certain computers, or on specific days,” explains Brook McKnight, PBVUSD network manager. Simply turning off monitors automatically generated significant savings; turning off PCs during nights and weekends saved even more. The district reduced its energy use by about 25 percent, saving approximately \$60,000 in utility costs in the first year.⁸

Data and analytics can also help tackle the excruciating details of grant compliance. K-20 institutions receiving federal grant monies must spend funds in compliance with certain regulations, but oversight is difficult for both the grantor and grantee because of laborious record-keeping, and limited visibility into how agencies award funds and how recipients spend them.

44%
of K-20 education leaders say the ability to analyze, track and predict institutional performance is a primary benefit of big data.

Source: CDE Big Data Survey, 2015



By using data analytics, administrators can organize and integrate data stockpiled in grant systems, data warehouses and spreadsheets, and gather new insights from grant, programmatic, financial and performance data.

Advancing Recruitment and Marketing Efforts, Improving Alumni Relations

As many private schools, community colleges and universities can tell you, recruitment and marketing are expensive. However, analytics can help by targeting an institution's market position to see how it performs within a region. By combining past performance, demographics and social media sentiment of current and former students, institutions can build profiles for other potential applicants. Once applicants are secured, student management data can be used to predict applicant behavior or define the general makeup of an admitted class.

These processes help institutions avoid enrolling too many or too few applicants; gauge the need for classrooms, instructors and other resources that affect the bottom line; or define areas of academic interest among potential students.

On the flip side of recruitment is alumni relations. Whereas eliciting alumni and supporter contributions was once an art, it is now a true science — 23 percent of K-20 education leaders report using data to drive alumni relations. The entire student life cycle is carefully parsed from applicant to enrolled student to alumnus, extracting data to predict likely contributors.

Predictive modeling and data mining — tempered by logistic regression filters that refine results — can vastly streamline the solicitation process and target donors. Rather than distributing mass mailings, telephoning or holding events in a scattershot approach, analytics can look at factors that affect individuals' propensity to give, including the amount of student debt they have, their age or the tax benefits they will receive. Analytics also provides information about the

best times to reach out for donations, such as a particularly successful athletic season. Given the vast amount of information institutions collect on their alumni, this analysis can offer a laser focus on prospects who might otherwise be missed.

Garnering Statewide Insights

While data used at the individual institution level can garner insights for schools, districts and colleges, statewide longitudinal data systems (SLDSs) help connect data from each stage of education — from K-12 through higher education, and even into the workforce. SLDSs are intended to enhance the ability of state-level decision-makers to more accurately collect, manage, analyze and use data from individual student records. Through the insights gathered by the SLDSs, states are able to improve student learning and facilitate research to close achievement gaps on a larger scale. Education institutions are also tapping into SLDSs to help gauge student success against overall state performance.

Some institutions can be leery of SLDSs. They fear loss of local control and the inability to maintain authority over collected data. On the other hand, some institutions are realizing the benefits of SLDSs and are fully embracing them. For example, the Georgia Department of Education constructed an online tunnel to link every K-12 school district's student information system (SIS) with the SLDS, allowing administrators, principals, teachers and agency officials to access and compare state and local performance information.⁹

The state of Michigan keeps its finger on the pulse of its schools via an SLDS dashboard, which looks at key metrics around reading proficiency, reports of bullying, student participation in the National School Lunch Program, and retention and graduation rates.¹⁰

And Virginia has been mining student data from all public and nonprofit colleges since 1992. The focus today is on student success, with graduate data from two decades included in reports on wage

23%

of K-20 education leaders report using data to drive alumni relations.

Source: CDE Big Data Survey, 2015





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earning. Tod R. Massa, Virginia's director for policy research and data warehousing, says the reports "help students understand the trajectory of earnings and student loans, so they understand the economic impact of their education decisions." The reports also help illustrate the impact of policymaking to legislators. "Our goal is to create an environment in which discussions are based on facts, rather than myth or conjecture," Massa says.¹¹

Building Tomorrow's Workforce

Data from SLDSs and individual institutions is also being used to prepare students for the workforce. This is critical because, according to a 2012 study, while 72 percent of education institutions said their graduates were ready for the workforce, only 42 percent of employers agreed.¹²

Currently, 43 states link K-12 data systems with post-secondary data systems; 19 states link K-12 and workforce systems; and 27 states connect post-secondary and workforce systems. By sharing vital data about graduates' performance in the workforce, education institutions can make needed adjustments to programs or

curriculum to ensure students are equipped with the right skills to be successful after graduation.¹³

As a result of this data, universities in Pennsylvania have developed hundreds of new degree programs in the last five years, discontinued others and are working with industry partners to develop programs that cultivate appropriate skills in students. Two-year colleges are also creating more robust workforce development programs by providing job-specific courses. Online degree programs are following suit.¹⁴

ORU is using data to help students predictively analyze themselves and gain greater understanding of what they need to do to be successful as they look for work and begin careers. "We now have the capability to access the U.S. Bureau of Labor Statistics on students' smartphones. We also designed a 'My Life Data' button, which will take data from a variety of sources from the students' experiences. It will start giving them information such as, 'You've reached 85 percent of your academic goal' or 'Here are the jobs that are available according to the credentials that you now own' or 'You are rated within the top 15 percent of students who could apply for specific jobs,'" says CIO Mathews. ■

Michael Mathews, CIO of Oral Roberts University, helped launch a "My Life Data" button, which aggregates data from a variety of sources to provide students with insights into their academic progress, next steps and available jobs.

TAMING THE BIG DATA BEAST

Utilizing big data does not come without its challenges. From gleaning actionable insights to scaling storage and other infrastructure components to protecting student privacy, education decision-makers must take several considerations into account before deploying a big data initiative. However, the hurdles presented by big data can be overcome, leaving education institutions with quality insights to drive better student and organizational outcomes.

Siloed Data, Lack of Insight

For years, many institutions have relied on monolithic databases — age-old systems too intractable to mine for meaningful insights. The result is a wide array of data silos incapable of communicating with one another and difficult to manage.

By integrating data gleaned from all applications, systems and sources into a central technology foundation, institutions can more easily analyze and convert data into actionable insights. It isn't enough to just add a dashboard on top of a legacy system. Rather, institutions that take the time to build a foundation will discover a powerful platform for strategic decision-making, eliminating the need for separate tools for tasks such as budgeting.

“Over the last 15 to 20 years, more database systems have become available, but institutions don't understand that it's not just having a series of databases that's important — it's the integration of those databases and the selection of data used appropriately to get the best

decision-making. That's the key,” says Reid-Martinez, provost of ORU.¹⁵

Breaking down data silos requires delivering information to practitioners and students in a meaningful way — users must see the insights data provides, not just the numbers. Appropriate training and support from decision-makers helps ensure data is used properly. The sections that follow describe solutions to overcome this challenge.

“This is continuous work — business intelligence, reporting data — and it's never finished. If it were finished, you've likely missed the mark completely.”

Doug Ferguson, Manager of Business Intelligence and Data Governance, Denver Public Schools

Data Warehouse

One solution to eliminating silos is a data warehouse, which can serve as an integrated, granular, single point of reference for informed decision-making and reporting. This is the case for Denver Public Schools (DPS). On a nightly basis, developers for DPS pull data from more than 20 source systems across the district into a central data repository. The information is normalized, built into analysis service cubes and made available for a large audience of users to conduct cross-silo reporting.

Doug Ferguson, manager of business intelligence and data governance at DPS, says, “It allows us to build one version of the truth, which contains the most common data

aggregations folks are looking for.”¹⁶ Soon, those with no technical training will be able to input their parameters and pull their own reports.

Ferguson and Sharyn Guhman, CIO for DPS, say the effort to establish the DPS data warehouse was a phenomenal undertaking 10 years in the making. “With the increasing skill level of our end-user population, we’re seeing a lot of folks who want big swaths of data to do their own analysis,” Guhman says. “It’s really exciting, but the level of nuance and detail in a data store like we have is tremendous, and they need to have the sophistication to know what they’re working with. It’s important to work through how you set people up to self-serve and do more on their own without creating a bottleneck in the shop, while making sure the data continues to have integrity.”¹⁷

Ferguson advises that anyone building their own data warehouse should know it will never be completed in one fell swoop. “This is continuous work — business intelligence, reporting data — and it’s never finished,” he says. “If it were finished, you’ve likely missed the mark completely.”

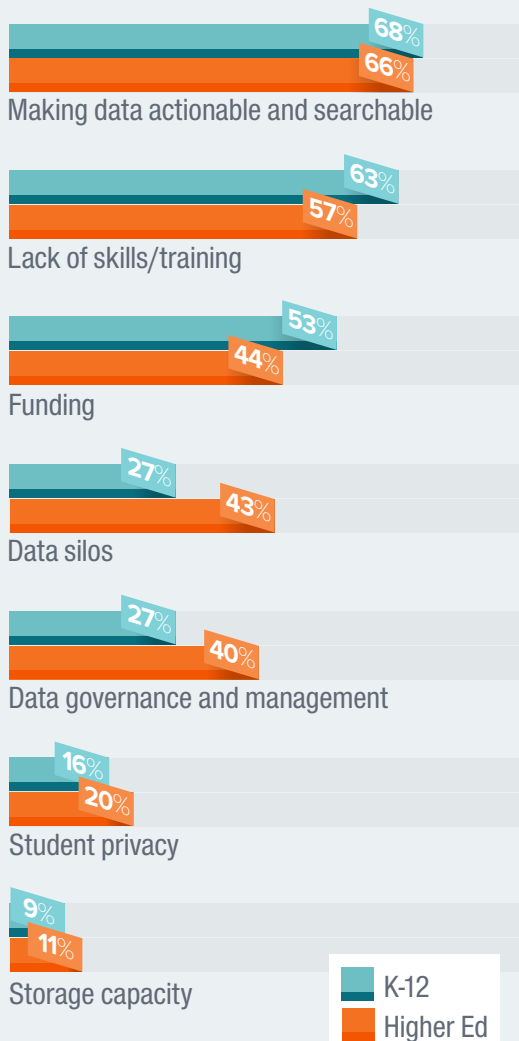
Before implementing a data warehouse, institutions and vendors must agree to the same set of standards. Decision-makers can turn to organizations such as the IMS Global Learning Consortium, which provides a framework for setting and adopting these standards.

Data Lakes

Despite the benefits of traditional data warehouses, they often use a single data design model, which all information must conform to in order to be loaded and analyzed. However, data doesn’t always fit into these neat boxes — particularly in learning institutions where data may be sourced from email, text documents, videos, photos, audio files, sensors and social media posts.



What are your institution’s challenges with big data and analytics?



Source: CDE Big Data Survey, 2015



North Carolina State University's James B. Hunt, Jr., Library uses data lakes to support its ability to use visualization technology on a large scale.

In contrast with data warehouses, where data is transformed and never loaded until the use for it has been defined, data lakes accept all forms of information. Raw information runs into them from a host of source systems and resides there untransformed until analysis is needed. For unstructured data in particular, the data lake will become the disruptive “must-have” for education institutions.

For instance, North Carolina State University uses data lakes to support its digital library — the James B. Hunt, Jr., Library. The library is a haven for students and faculty to work on new ideas, experiment with and visualize technology on a large scale, and tap into advanced analytics to unearth new insights — all of which requires the ability to scale as data is added. Data lakes offer a single repository for immense amounts of information in any format.¹⁸

Integrator middleware permits database administrators and warehouse specialists to handle big data repositories like any other source, allowing

organizations to draw data from numerous sources and formats. Increasingly, other technologies that can analyze and integrate unstructured data will proliferate. Building catalogs and governance around the lake will be its greatest challenge, but make no mistake — this is the data architecture of the future.

Data Analytics

Data analytics, or the measurement, collection, analysis and reporting of data, is driving decision-making in many institutions. However, because of the unique nature of each district's or college's data needs, many are building their own solutions.

After receiving a \$31 million Race to the Top - District Grant, Cody Grindle, director of software development at IDEA Public Schools in Texas, launched an ambitious initiative to create a data analytics platform, which he believes will transform instruction and learning. Slated for completion at the end of 2015, the platform will collect and store data in a centralized warehouse where advanced algorithms will use it to make

recommendations that drive instructional and policy decision-making.

Analytics will look at demographics and assessments to cluster students into learning cohorts and search for patterns to predict how well they'll perform in the future. "This gives a teacher a suggested path with recommended priority objectives that will have the greatest impact on subject mastery," says Grindle. "Analytics can lend more confidence to the process, looking further backward and forward and adding more value in an efficient, organized way."¹⁹

Data Visualization and Dashboards

Sixty-eight percent of K-12 and 66 percent of higher education CDE survey respondents said making data searchable and actionable was their greatest challenge with big data. Dashboards provide administrators, instructors, parents and students with a visual representation of performance, often in real time. This visualization allows educators to act on valuable data, such as identifying gaps in student performance. Armed with easy-to-understand information, educators can respond quickly and meaningfully with support or interventions.

The University of Texas (UT) developed a data visualization tool for a macro-level look at its performance compared to other schools in the UT system and elsewhere. This productivity dashboard provides unprecedented transparency to the state, with online business intelligence and data that can inform decisions and policy creation.

Dr. Stephanie Huie, vice chancellor of the school's Office of Strategic Initiatives, says, "There are a lot of great data visualization tools out on the market. Many of these have the added advantage of allowing users to guide their experience by picking elements they want to focus on in the visual. Effective data visualizations tell a story by looking for patterns. Data combined with the right tools should lead to explanations and discovery."²⁰

Data Governance

Data can be the most valuable asset an enterprise possesses, sharpening practices to yield superior results. But poor data quality undermines those efforts, which is difficult to reconcile given the enormity of information collected.

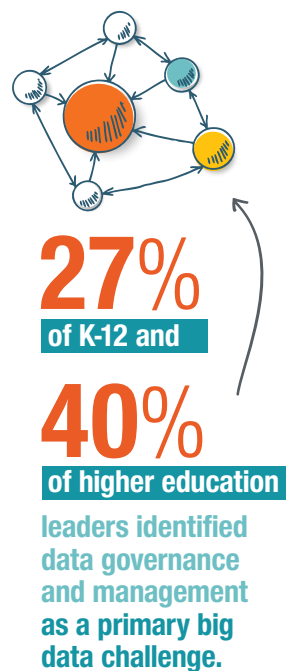
According to the CDE survey, 27 percent of K-12 and 40 percent of higher education leaders see data governance and management as a big data challenge. And this issue is not something schools can simply hand to the IT team to solve — the root problem lies with leadership, staff and faculty, so they must have a hand in eliminating redundancies and establishing and abiding by data quality rules. Because research, curriculum, student services and instructors contribute to the types of data needed and the manner in which it is reported via dashboards, a data warehouse approach tends to create a more collaborative environment with the IT department. Some institutions, districts and states have put together committees tasked with data oversight.

Wichita State University implemented a Data Governance Council (DGC) to manage the college's data systems. The mission of the DGC is to ensure data integrity, implement best practices, adhere to reporting standards, maintain data consistency and enable secure access. The DGC also identifies gaps in data reporting or needs related to strategic planning. This process helps protect student and faculty data, including personally identifiable information (PII), and ensures strategic use of data for decision-making.²¹

Student Privacy and Data Security

Privacy

There is no question data is a powerful tool capable of transforming education. But as technology becomes increasingly sophisticated at mining data and making connections, there is growing concern that big data's benefits come



Source: CDE Big Data Survey, 2015

with too high of a price. Specifically, increasing numbers of people are wary of intrusions on their privacy, particularly when that perceived invasion involves their children.

For example, in 2014 the nonprofit company inBloom, Inc., backed by \$100 million from the Gates Foundation and the Carnegie Foundation for the Advancement of Teaching, closed its doors amid controversy regarding its plan to store, clean and aggregate a range of student information for states and districts and then make the data available to district-approved third parties to develop tools and dashboards so the data could be used by classroom educators.²²

States are taking action to protect students' privacy — in 2014 alone, 35 states considered 110 bills directly addressing student data privacy. Of these, 21 states signed 30 bills into law.²³ At the federal level, in May 2015, two U.S. representatives introduced the Student Digital Privacy and Parental Rights Act — a

measure that would prohibit school technology vendors from selling student information to third parties or from creating student profiles for non-educational purposes.

The bill is certain to receive support from President Obama. In January 2015, the White House outlined its own legislative proposal designed to ensure data collected in the educational context is used only for educational

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purposes. At the time, President Obama remarked: "If we're going to be connected, then we need to be protected. ... Each of us as individuals have a sphere of privacy around us that should not be breached."²⁴ In 2011, The U.S. Department of Education appointed its first chief privacy officer to support states and districts.

Privacy protection isn't only a concern of the government. In March 2015, the Consortium for School Networking (CoSN) and the Data Quality Campaign released 10 privacy principles that earned the support of more than 30 education groups representing education leaders, teachers and parents.²⁵ Additionally, CoSN and other organizations such as Common Sense Media have created guidelines and tools for districts in an effort to further protect student data.

While privacy is important, some data advocates worry that establishing restrictions will prevent educators and others from fully leveraging technology. Noelle Ellerson, associate executive director of AASA, The School Superintendents Association, understands the concerns, but believes overreacting could hinder



Tips for Student Data Privacy

Know the Laws and Regulations



There are many regulations on the books intended to protect student privacy and safety: the Family Educational Rights and Privacy Act (FERPA), the Protection of Pupil Rights Amendment (PPRA), the Children's Internet Protection Act (CIPA), the Children's Online Privacy Protection Act (COPPA) and the Health Insurance Portability and Accountability Act (HIPAA) — as well as state, district and community laws. Because technology changes so rapidly, it is unlikely laws and regulations will keep pace with new data protection needs. Establish a committee to ascertain your institution's level of understanding of and compliance with these laws, along with additional safeguard measures.

Make a Checklist



Your institution's privacy policies should cover security, user safety, communications, social media, access, identification rules, and intrusion detection and prevention.

Include Experts



To nail down compliance and stave off liability issues, consider tapping those who protect privacy for a living, such as your school attorney, IT professionals and security assessment vendors. Let them review your campus or district technologies as well as devices brought to campus by students, staff and instructors. Finally, a review of your privacy and security policies, terms of use and contract language is a good idea.

Communicate, Communicate, Communicate



Students, staff, faculty and parents all need to know their rights and responsibilities regarding data privacy. Convey your technology plans, policies and requirements and then assess and re-communicate those throughout each year.

the positive benefits of data. “Fear stems from lack of information, and the most important thing for stakeholders to remember is that student data and the educational record is not new,” she says. “It has existed as long as there has been education. The discussion now is merely about how to ensure the privacy and protection in the presence of third-party vendors. In a safeguarded environment that allows candid conversation among stakeholders, big data will be absolutely empowering and transformative”²⁶

One answer to privacy fears is proposed in the previously mentioned Student Digital Privacy and Parental Rights Act, which calls for the use of de-identified student data that would still allow vendors to use information to personalize

learning and improve their products. However, critics don't believe de-identified data solves the issue at hand. A researcher at Massachusetts Institute of Technology (MIT) was able to analyze de-identified credit card data and discern the cardholders' identities.²⁷ Using similar techniques, student identities and connected data could also be identified. There is more work to be done around the de-identification of data before it can solve education's data privacy challenges.

The U.S. Department of Education's Privacy Technical Assistance Center (PTAC) released suggestions to help education decision-makers understand and implement best practices to protect student privacy. The guidance summarizes the Family Educational Rights and Privacy



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To protect research efforts from hackers, the University of California, Berkeley's Electrical Engineering and Computer Science program implemented a protection platform to instantly identify threats.

Act (FERPA) and the Protection of Pupil Rights Amendment (PPRA) and encourages the use of best practices for vendor-managed functions such as online educational services, mobile applications and Web-based tools.

PTAC issued this guidance in an effort to address questions regarding the use of student data and the steps necessary to protect students' privacy. Questions addressed include: "What does FERPA require if PII from students' education records is disclosed to a provider?" and, "Do FERPA and PPRA limit what providers can do with the student information they collect or receive?"²⁸

Security

According to the Privacy Rights Clearinghouse, 30 education institutions experienced data breaches in 2014. The largest was at the University of Maryland, where more than 300,000 student, faculty and staff records were compromised.²⁹ In 2013, the names, Social

Security numbers, birth dates and home addresses of 6,300 active Metropolitan Nashville Public Schools teachers were stolen and transferred to an unencrypted personal computer.³⁰

The University of Maryland and Metropolitan Nashville Public Schools aren't alone. Education institutions are a tempting target for hackers due to the copious amounts of PII and other data they house. Research institutions are particularly vulnerable and pilfered data may not be noticed for months or years until a product that happens to emulate university prototypes pops up in another part of the world.

But even as security threats become increasingly advanced and persistent, education institutions are finding ways to ward off attacks. For example, the University of California, Berkeley's Electrical Engineering and Computer Science program is a world-class environment for 1,500 students competing to learn cutting-edge skills and make breakthroughs. Given the department's talent level and creativity, the school network is highly desirable to hackers, making security a tall order for the university's IT team.

The university implemented a protection platform to instantly identify threats not detected by existing security measures anywhere else. Fred Archibald, computing infrastructure manager, says, "Cyber criminals are making substantial and ever-increasing investments in malware, and new threats are constantly being introduced. There is no way that even a really good suite of traditional security applications can cope." Archibald says the new platform is effective because it doesn't utilize existing signatures or patterns, but hunts for suspicious activities to gauge if a behavior is dangerous. Once malicious threats are matched and verified, details are shared with subscribers before a forensic investigation proves the attack is real and addresses it. "This platform gives us a truly global perspective on malware outbreaks," says Archibald.³¹

Outdated IT Infrastructure

Storage

As data increases in size and applications become more complex and interconnected, storage teams continue to be overburdened with laborious IT processes. For education institutions, these can be frustrating, expensive problems.

All-Flash Storage. One game-changing tool is all-flash storage, which offers fast access and high performance in education environments struggling with rapidly growing data and an infrastructure that is unable to efficiently process it. Benefits include significant data reduction and no penalties for storing virtual desktop infrastructure (VDI) images.

Judson Independent School District in San Antonio, Texas, is leveraging all-flash storage arrays for efficient storage capabilities. While the district originally implemented all-flash to support its VDI, it is now expanding its use to support other applications and has installed an all-flash array in each of its three data centers to support back-office financial systems, servers and network monitoring. “Data storage is the backbone of the district,” says Chris Dean,

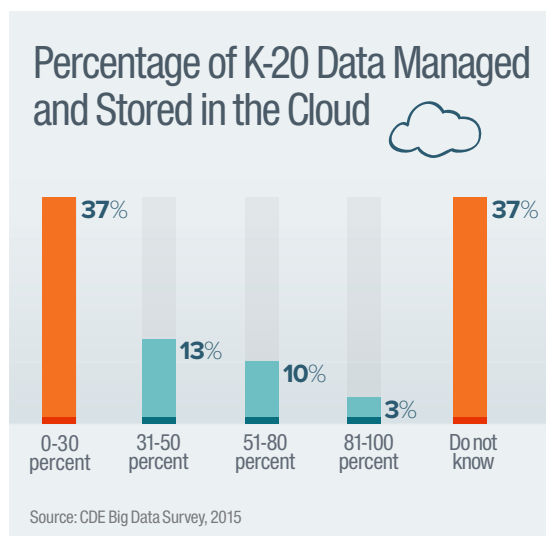
“Data storage is the backbone of the district. Student access is dependent on data — how quickly we can read and write.”

Chris Dean, Director of Network Services, Judson Independent School District

director of network services for the district.

“Student access is dependent on data — how quickly we can read and write.”³²

Similarly, all-flash storage has been essential to a smooth transition to VDI for the University of Texas at Dallas (UT-Dallas). John McConnell, manager of the School of Engineering at UT-Dallas, is particularly enthusiastic about the deduplication and compression features of the technology. McConnell says one of the biggest operational challenges with VDI is “recomposing, a step in which all desktop machines are synced to the parent virtual machine containing the master software image.” McConnell maintains 13 master images of varying sizes, some of which have reached 200 GB. But with all-flash storage, he has achieved an 8:1 data reduction and doesn’t have to pay a penalty for storing the images.³³



Storage Services Catalog. Another solution is a storage services catalog, which can simplify processes and management through automation. Catalogs permit staff members to make choices about what services IT will (and will not) provide, and at what cost. IT staff then establish reservoirs of standardized data offerings that meet the majority of daily requirements, enabling a healthy ration of self-service by users, which allows IT staff to pursue more complex or meaningful tasks.

In the education space, a services catalog can include standardized service cubes for assessments, lesson plans and classroom management, content management for instructors and students,

Cloud computing allows education institutions to replace existing physical data centers, servers and applications with high-capacity infrastructures and centralized data and applications. In this way, cloud computing offers a smart, affordable way to support big data technologies and advanced applications.

professional development, and school asset tracking for equipment and supplies.

Cloud. Cloud computing allows education institutions to replace existing physical data centers, servers and applications with high-capacity infrastructures and centralized data and applications. In this way, cloud computing offers a smart, affordable way to support big data technologies and advanced applications.

K-12 school districts coping with budget and staff cuts, high HVAC costs, proliferating mobile devices and gluts of data can find a solution in the cloud, along with the chance to hand off services and maintenance tasks that frees their IT staff for more strategic work. Often-decentralized universities can enjoy all of the above plus the interoperability, efficiency and cost effectiveness of an integrated system. For any learning institution, peace of mind is assured with student, employee and institutional data in the cloud for disaster recovery and business continuation.

The cloud encourages collaboration, allowing expansion for research projects among far-flung partners to share new ideas, practices, knowledge and better outcomes. In the future, look for tighter collaboration between higher education research institutions and the private sector in the cloud, as the former relies less on on-premises infrastructure and architecture and enjoys access to resources, materials and credibility offered by commercial enterprise.

For institutions uncomfortable with full cloud adoption, the hybrid cloud solution — where more sensitive data is stored on-premises — can fit the bill. Developing a cloud strategy ahead of time can ease concerns about security, governance and compliance, and lay a strong foundation for success.

“Anything-as-a-Service” or “X-as-a-Service” solutions can help K-12 and higher education institutions cope with big data by offering storage, analytics capabilities and more. These include:

- **Infrastructure-as-a-Service (IaaS):** Providers offer cloud-based storage, similar to a campus storage area network (SAN)
- **Platform-as-a-Service (PaaS):** Opens up application platforms — as opposed to the applications themselves — so others can build their own applications using underlying operating systems, data models and databases; pre-built application components and interfaces
- **Software-as-a-Service (SaaS):** The hosting of applications in the cloud
- **Big-Data-as-a-Service (BDaaS):** Mix all the above together, upscale the amount of data involved by an enormous amount and you’ve got BDaaS

Networks

When it comes to data and analytics in education, the demand on networks is two-fold. First, as learning environments evolve

and education is offered anytime, anywhere, educators and administrators increasingly need access to data 24/7 and in any location. This requires a robust wireless network both on and off campus. Solutions such as a dedicated on-campus Wi-Fi network and the combination of cellular, 4G and wireless protocols help ensure a reliable on-campus connection. And to bridge the gap in connectivity off campus, grants through the White House's ConnectedED initiative are available to qualifying schools. Because connectivity is used as a utility — with the same expectations as energy — it should be moved to the utility budget. It is not a fixed resource, but one that will change with usage, just like electricity.

Secondly, as the volume of data increases so must the capacity of the network. But many education institutions find their outdated network infrastructures are struggling to keep up with demand from students' mobile devices, let alone unprecedented levels of data transfer. According to a recent survey, 42 percent of K-12 school officials said their network services are too slow, while a similar percentage said they lack network capacity to accommodate growing digital needs. Network reliability is also suffering — nearly 40 percent of those surveyed said downtime and interruptions challenge their organizations, and they found it difficult to quickly increase capacity.³⁴

For these institutions, developing a plan that maps out long-term bandwidth needs is critical. After quantifying capacity needs, leaders should evaluate their options for networking services that will serve their requirements in the years ahead. For applications that require the highest performance levels, an all-fiber network for the local area network (LAN) and wide area network (WAN) may be the best choice. A fiber-optic network backbone balances high-performance, scalability and economical needs. Scaling is simple with fiber — schools can simply contact their service providers to

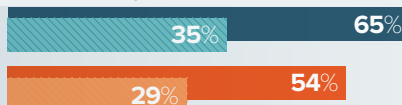
My institution **uses** the following data and analytics tools and technologies:

■ K-12 ■ Higher Ed

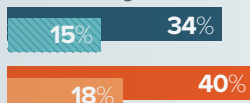
My institution **plans to implement** the following data and analytics tools and technologies in the next 12 to 24 months:

■ K-12 ■ Higher Ed

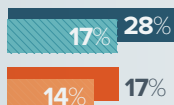
Dashboards/Portals



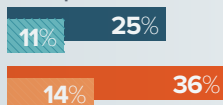
Data Mining



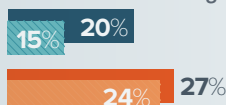
Master Data Management



Enterprise Data Warehouse



Predictive Modeling



Source: CDE Big Data Survey, 2015

adjust their contracts if demand increases and they need to upgrade from initial 100 Mbps services. Institutions can buy what they need when they need it and can scale up in any increment when they need additional capacity.³⁵

In higher education, research universities in particular need network infrastructure that allows researchers to quickly access big data anywhere on the planet — with data set sizes often measured in petabytes. “If you’re going to be serious about research, you need up-to-date, even leading-edge network capabilities because collaboration and data volumes are growing across all academic areas and in the university’s business operations,” says Clemson University CIO Jim Bottum.³⁶

“If you’re going to be serious about research, you need up-to-date, even leading-edge network capabilities because collaboration and data volumes are growing across all academic areas and in the university’s business operations.”

Jim Bottum, CIO, Clemson University

To accommodate high data volumes across research, academic and business applications, research universities can leverage a high-capacity connection from the university network to advanced networks such as Internet2. Today, 100 GbE is the baseline for high-performance networks; in most cases, 100 GbE investments also provide a platform for scaling up to 400 GbE in the future.

Given the demands of high-bandwidth applications and huge data volumes, another option for research universities is to segment and optimize a portion of the university network specifically for moving the enormous scientific

and engineering data sets among researchers. A science DMZ serves the performance and access needs of researchers without creating a negative impact on other institutional traffic.³⁷

Skills and Training

More than half of K-20 education leaders identified a lack of training and skills as a primary challenge to leveraging big data for decision-making. To overcome this, some institutions are hiring highly skilled analysts to sift through data.

Nazareth College’s Mortimer says tapping highly skilled statisticians is a key to success, conceding that the Ph.D. with rich statistical skills running the IT department at Nazareth is a rare luxury. “Our team members aren’t just data handlers,” he says. “They’re incredibly curious and gifted in terms of statistical analysis and looking at questions through a variety of lenses. Human curiosity as part of the process and understanding goals and objectives of questions is really important.”

Ryan Baker, associate professor of cognitive studies at Columbia University’s Teachers College, established a master’s degree program in part to address what he saw as a lack of mastery in learning analytics and educational data mining. “In curriculum companies and universities developing online learning platforms, the demand for good people trained in those areas is higher than the supply,” he says. He doesn’t, however, think most schools have a data miner on staff, nor does he think that’s a problem.

“I hope we get to where most of the curricula and systems used in schools are created with a data analytics or education data mining person to develop models that transform raw data into actionable information, so that a busy teacher or guidance counselor can figure out what kids need and how to better support them,” he says.³⁸ ■



42%

of K-12 decision-makers say their network services are too slow.

Source: www.centerdigitaled.com/paper/6-Steps-to-Network-Modernization-Success-in-K-12-Education.html



BEST PRACTICES FOR DATA-DRIVEN CLASSROOMS AND CAMPUSES

Many institutions, now several years into their analytics initiatives, continue to use data to drive decision-making processes. However, throughout this process, they've learned a lesson or two. Following are words of wisdom from industry and education leaders, aimed at helping others avoid the pitfalls of data.

Use accurate data correctly. Inaccurate data can lead decision-makers down a rocky path. Additionally, data in the hands of the wrong person can be just as treacherous. Analytics and big data must be designed correctly and validated. Bad data-driven decisions are likely to occur with a poor system design.

Define goals and develop metrics. Education institutions must create a strategy for collecting, reporting, analyzing and determining next steps in the data analytics process. It's critical for instructors and administrators to be able to easily access data and see patterns and trends. It's also important to give stakeholders adequate time and training to examine data, think about the implications and strategize next steps. Commit to importing benchmark assessments and running reports to reveal instructional efficacy and learning progress. Communicate

decisions and impacts — without this feedback loop, your data analytics vision will not result in action.

Eliminate silos, integrate data. Data systems can be islands of isolation, often thwarting the ability to generate meaningful data about student performance in real time. Silo busting is extremely hard to pull off, but it can result in superior information, creative problem solving, deduplication and consensus building. Develop a structure and processes, then assemble and maintain data teams. Determining governance and monitoring policy compliance can be overwhelming, but it is a necessary step. Also, look to Web-based tools and open data sources so instructors have a common pool from which to draw and input data, and have formal, cross-discipline, leadership-backed conversations with colleagues about integrating data in earnest.

"The challenge over the years has been granularity," says ORU's Reid-Martinez. "Either there is so much minutiae you can't find your way out of it or you get a nice big picture and you can't get the data that you need for decisions that need to be made. With new capacities such as housing data in the cloud, we can easily

aggregate the data and get the right information to the right person at the right time for decision-making — that’s our ultimate goal.”

Remember, intelligence is the goal.

Data is not helpful if it doesn’t provide insight. Decision-makers should be able to discern the difference between necessary data and “nice to know” data. “Keep it simple,” says Mathews of ORU. “Don’t sell analytics, sell intelligence.”

Maintain a robust, supportive enterprise infrastructure. A traditional infrastructure includes hardware, software, facilities and networks to deliver IT services, but in today’s device-heavy, BYOE (bring your own everything) world of education, middleware is crucial in order to float the whole enterprise. Additional elements must provide for Wi-Fi access, substantial broadband and ubiquitous-access platforms with capacity for

device apps, browsers, virtualized desktops, cloud services and identity management.

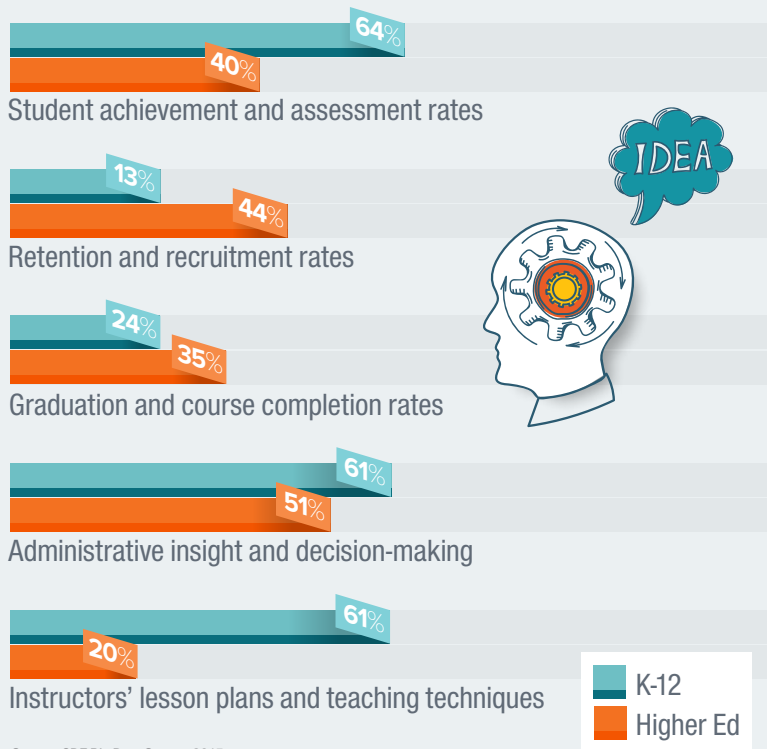
Prioritize student privacy. Fully integrate all privacy regulations into organizational practices, developing policies to share and protect student data. Utilize strong data security strategies; be open and transparent about who is using data and why; and make it simple for parents to understand what student data is being collected, stored and shared.

“What works for one institution won’t necessarily work for another. It’s important to ensure the general community understands what big data is, what the school is collecting and how it is being used. If student data is not protected and treated with high standards, it is understandable that parents would want to opt out,” says Ellerson of AASA, The School Superintendents Association.

Develop bullet-proof data governance guidelines. Privacy and governance go hand-in-hand. As public sector systems are hacked and liability issues arise, data ownership and access will increasingly be a hot-button issue in education circles. Data governance involves changes in behaviors and organizational culture, so building a strong case to articulate goals and benefits is crucial. Once guidelines are established, institutions will need strong leadership and backing from above to make them stick.

Create a culture of collaboration and sharing, not compliance. Weekly meetings about data are important, but instructors can also use data for collaborative meetings to consider student needs and share best practices across a grade or subject area. Leadership can use data to determine which faculty and staff might benefit from coaching or professional development. This also provides a feedback loop to make sure the data collected is relevant and informing decisions. Collecting data and reporting data for the sake of it is a waste of time. Most importantly, be sensitive in establishing the institution’s data culture — everyone is starting from a different place. ■

Data and analytics have improved:



DATA-DRIVEN RESULTS

Used appropriately, data analytics can provide objective, longitudinal analysis that dramatically improves educational effectiveness; enhances decision-making; and powers real-time, continuous classroom, school district and campus improvement. Big data isn't a silver bullet, but a data-driven education strategy can be. Well-designed data-driven strategies provide actionable insights that lead to more and better choices for teaching and learning, and, ultimately, to performance-driven education.

As the demand for efficient methods and systems for collecting, processing, analyzing and

storing educational data continues to grow, a clear and effective approach is required to enable education institutions to evaluate their needs, resources and goals. Collaboration, communication and transparency among all stakeholders, including educational organizations and agencies, grant funders, policymakers, elected officials, accrediting bodies, parents and instructors, are critical to establishing a true data culture that takes student, educator, district and institutional performance to new levels of excellence. In the end, it is big data's role in helping students successfully navigate their education and careers that demonstrates its greatest value. ■



BIG DATA

ACCORDING TO THE EXPERTS

“We live in a world where analytics for students and instructors collide — as they should. It’s a tight relationship and when everyone understands what the numbers are used for, we reach a shared goal. That’s where analytics transforms learning.”

Carmen Zannier, Ph.D., Development Manager, D2L

“We’re not trying to make simple tasks mundane, we’re trying to make impossible tasks manageable.”

Bill Schmarzo, Chief Technology Officer, Big Data Practice,
EMC Global Services

“Today, the IT team can play a key part in business transformation by building infrastructure that scales and is fast and reliable. Making data faster and more accessible to business users results in greater outputs for any company.”

Yousuf Khan, Vice President of IT, Pure Storage

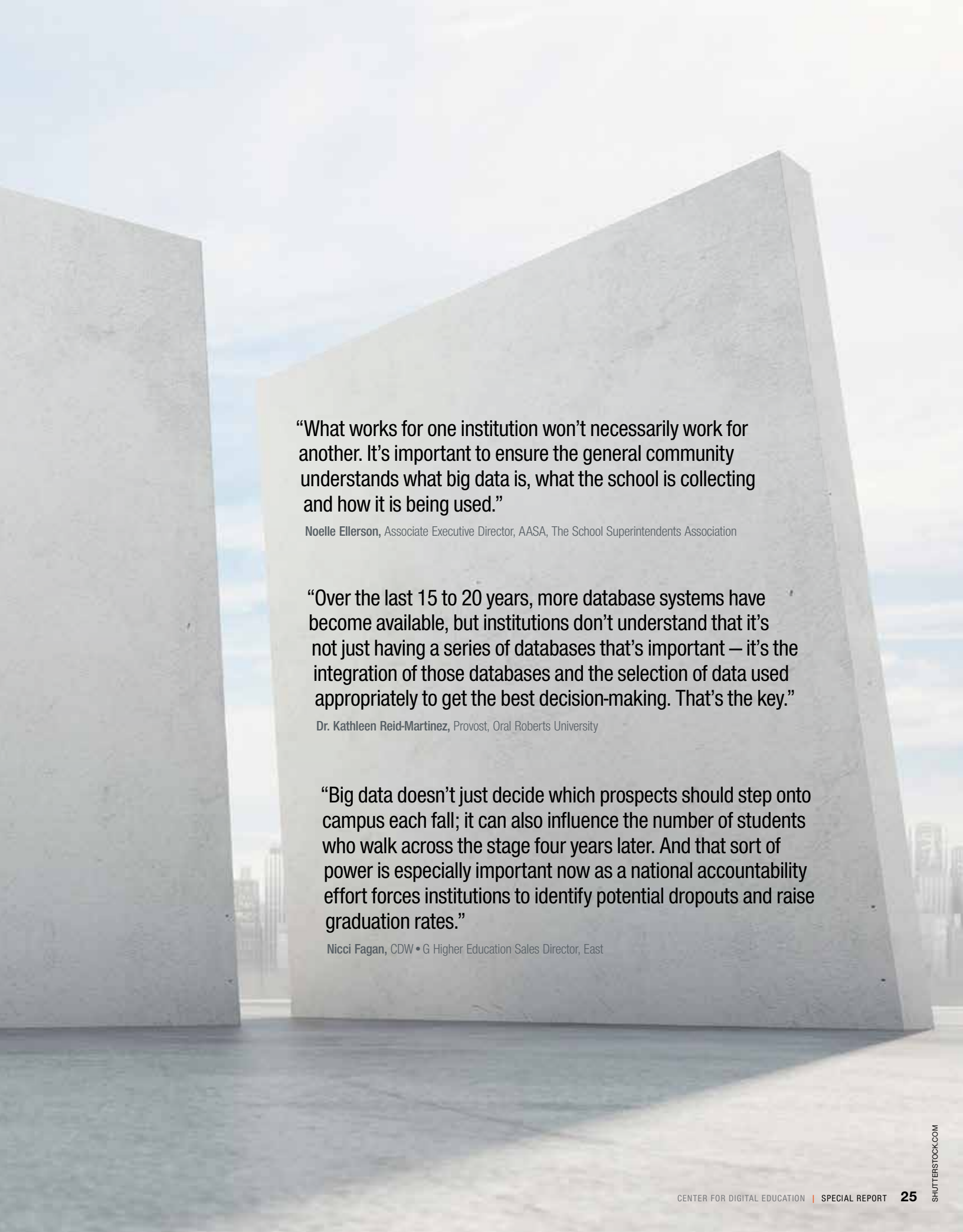
“It’s important to work through how you set people up to self-serve and do more on their own without creating a bottleneck in the shop, while making sure the data continues to have integrity.”

Sharyn Guhman, CIO, Denver Public Schools

“Today, curriculum delivered through technology should be as available to a 21st-century learner as content within a textbook. Safe and secure access must be open to all students both on and off campus.”

Josh Howell, National Strategic Operations Manager
— Education, Sprint





“What works for one institution won’t necessarily work for another. It’s important to ensure the general community understands what big data is, what the school is collecting and how it is being used.”

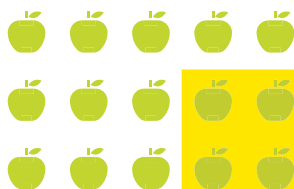
Noelle Ellerson, Associate Executive Director, AASA, The School Superintendents Association

“Over the last 15 to 20 years, more database systems have become available, but institutions don’t understand that it’s not just having a series of databases that’s important — it’s the integration of those databases and the selection of data used appropriately to get the best decision-making. That’s the key.”

Dr. Kathleen Reid-Martinez, Provost, Oral Roberts University

“Big data doesn’t just decide which prospects should step onto campus each fall; it can also influence the number of students who walk across the stage four years later. And that sort of power is especially important now as a national accountability effort forces institutions to identify potential dropouts and raise graduation rates.”

Nicci Fagan, CDW • G Higher Education Sales Director, East



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Data Lakes: Powering Digital Libraries & Driving Insights



PHOTO: NORTH CAROLINA STATE UNIVERSITY

Envision a library that provides a collaborative haven for students and faculty to formulate new ideas, experiment with and visualize technology on a large scale, and tap advanced analytics to unearth new insights. With help from EMC, a global leader in storage, cloud computing and big data solutions, that library exists today.

EMC recently partnered with North Carolina State University to provide its Isilon technology solutions to the James B. Hunt, Jr., Library, as part of EMC's Information Heritage Initiative, which focuses on preserving the world's information for future generations and making it globally accessible for research and education. The initiative also supports digitizing the world's great photos, writings, letters, film and music, including John F. Kennedy Library Foundation artifacts and the Vatican Apostolic Library historical documents.

These projects call for massive amounts of storage, and the ability to quickly scale as data is continually added from many sources. But as that information grows, traditional storage and data strategies often lead to inefficient, costly IT structures. Data lakes can solve this issue by offering a single repository for immense amounts of information in any format.

EMC Isilon Data Lake Foundation solutions allow education institutions and libraries to store, protect and manage unstructured data in a central repository — and speed data analysis to harness new insights.

At the James B. Hunt, Jr., Library, EMC data lake solutions support fresh ways for educators and students to investigate, model and share data — and visualize it on a large scale. EMC can provide your institution with the foundation to implement similar solutions and leverage the power of data.



EMC Data Lake Capabilities

EMC data lake products support education institutions and the use of data by:

- Removing inefficient storage islands and data silos
- Simplifying management
- Lowering infrastructure costs while improving IT productivity
- Enabling secure information sharing
- Increasing data security
- Scaling effortlessly from 16TB to 50PB
- Supporting existing and emerging workloads

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Bridging the Digital Divide – Providing Connectivity On and Off Campus

Schools across the U.S. are harnessing the power of digital learning. By implementing online programs, mobile apps and other learning technologies, administrators and teachers can derive valuable insights from the data gathered through these initiatives to improve student outcomes. However, the effectiveness of these programs, technologies and data is based on reliable access to the Internet.

On Campus Connectivity

Many districts plan to add or expand current use of digital textbooks and a large number will incorporate connected wireless devices for 1:1 learning. These initiatives require strong, reliable connectivity. However, building a framework for mobile learning remains complex and costly. Sprint provides cost-effective connectivity solutions that enable schools to implement new learning technologies:

Sprint Campus Connect — A dedicated on-campus Wi-Fi network built, owned and managed by Sprint at no upfront capital expense to schools. Sprint Campus Connect can deliver a combination of cellular, 4G LTE, land-mobile radio, RFID and wireless protocols. It provides network monitoring, notification and infrastructure maintenance, and is compatible with approved mobile devices.

Sprint Wireless Campus Manager — A complete infrastructure solution to simplify, manage and secure a school's mobile learning program using third-party providers under one contract. Components include a learning management system, mobile device management, help desk, learning device asset management, sourcing and procurement, and more. Wireless Campus Manager also reduces the time-consuming complexity of imaging, launching and managing mobile devices.

Off-Campus Internet Access

As K-12 campuses move to adopt digital programs and the systems needed to deliver mobile learning and curriculum, everyone wins — except, unfortunately, students without Internet access at home.

To help bridge this connectivity gap, Sprint offers grants to qualifying schools and districts. Through its collaboration with President Obama's ConnectEd initiative, Sprint will provide high-speed wireless service outside the classroom for up to 50,000 students for 4 years. Schools and districts that qualify will gain access to the Sprint 4G LTE network using a compatible device to ensure students without Internet access at home have the same opportunity to excel through mobile learning.

Whether school leaders have already launched a digital or mobile learning initiative, or aren't sure of where to start, Sprint can provide custom connectivity solutions so all students can achieve success.



To learn more, visit Sprint.com/k12



ConnectED: Offer ends 06/30/19. 3GB Data Service: 3GB/mo./line on-network data; excludes off-network usage, domestic voice, messages, & international services. Service avail. for max. 4 years from activation. Req. compatible device and eligible data device. Premium content/apps/downloads cannot be billed directly to acct. Customer responsible for other subscription charges. Approved device pricing subject to change. Usage Limitations: When monthly usage exceeds data plan allotment, speeds may be reduced or blocked for remainder of plan cycle. Data speeds restored when new plan cycle begins. Prohibited use limitations and network management rules apply. Visit sprint.com/networkmanagement for details. Solutions: Available on select devices and may require add'l plans/fees. Ct. only. Other Terms: Limited to eligible customers and is non-transferable. Line quantity limited. Offers and coverage not available everywhere or for all devices/networks. Sprint 4G LTE network reaches over 280 million people. Sprint 3G network reaches over 281 million people. Visit sprint.com/coverage for info. Restrictions apply. © 2015 Sprint. All rights reserved. Sprint and the logo are trademarks of Sprint. Other marks are the property of their respective owners.



Access Actionable Insights in a Flash

Higher education institutions are gathering data on student performance, dropout rates and fundraising to improve outcomes. However, due to legacy storage infrastructure, they cannot quickly or easily access this data to derive actionable insights. In addition, this outdated storage environment can increase costs, complexity and the data center footprint — with no guarantee of a similar increase in performance. The result is an inability for higher education leaders to harness data for strategic decision-making.

Flash: Affordable, Effective, Simple

Flash can be a game-changer for higher education institutions. In the past, an all-flash storage solution would have been too expensive to deploy across the data center, despite the performance gains. However, when compared to disk over a five-year period, the costs are comparable. This is largely because Pure Storage eliminates the need for costly and labor-intensive forklift replacements. Flash not only delivers better application performance, it gets data into the hands of decision-makers faster.

The Pure Storage all-flash array takes these benefits one step further by offering simplicity, using our self-provisioning Purity software to allocate workloads. With simple management and non-disruptive upgrades, IT departments can focus on more strategic data initiatives.

Pure Storage provides universities and colleges with a simple and affordable storage solution that supports data-based education initiatives to improve student outcomes.

Pure Storage provides the underlying technology that enables education institutions to fully leverage data for:

IMPROVED STUDENT OUTCOMES

Quick access to data insights enables faculty to alter instruction methods and administrators to make changes to campus culture.

DECREASED DROPOUT RATES

The ability to pinpoint the root cause of student academic challenges enables decision-makers to effectively address student needs and lower dropout rates.

IMPROVED ALUMNI RELATIONS

Alumni data is often siloed, causing fundraisers to focus their efforts on a handful of donors who contribute significant funds. Ensuring staff have quick access to alumni data can increase the donation pool and the potential for more funds.

ACCELERATED RESEARCH RESULTS

Quick, reliable storage ensures researchers have the proper tools in place to speed up research results, which provides a leading advantage.



To learn more about Pure Storage, visit:
www.purestorage.com

They see the
right data at
the right time.

ORAL ROBERTS UNIVERSITY DRIVES STUDENT SUCCESS WITH SMARTER DATA.

“We were looking to give our faculty as much data as we could to allow them to be proactive versus reactive. If you wait too long and rely too much on mid-term grades and performance, it’s just too late to intervene. Students will have gone through half the course and those at risk may consider dropping out.”

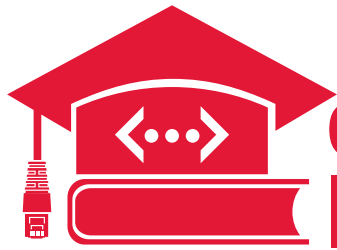
Dr. Kenneth Berchenbriter
Systems Analyst, Oral Roberts University (ORU)

The Brightspace learning platform’s analytics suite helped ORU faculty members visualize student performance and even identify struggling students with a data-driven early warning mechanism. Read the full ORU case study to find out how much online program enrollment and student retention improved—in one semester.

See their results: Brightspace.com/ORU

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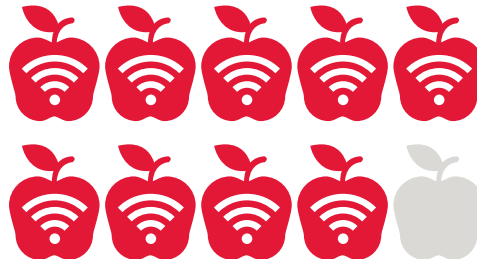
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With Common Core State Standards helping to spark a digital revolution in schools, your students need the right technology to prepare them for digital learning, online testing and the development they'll need to get to the next educational stage. They need devices, applications, digital content and a reliable network to access it all quickly.

69%
OF TEACHERS

say educational technology enables them to do "much more than ever before" for students.¹



9/10
TEACHERS

say that the Internet has a major impact on their ability to access important teaching materials.²



ONLY 28%
OF PUBLIC
SCHOOLS

have the broadband speed necessary to reliably access the Internet.³

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¹PBS Learning Media Survey, pbs.org, Feb. 2013 ²Pew Internet, *How Teachers Are Using Technology at Home and in Their Classrooms*, pewinternet.org, 2013

³Washington Post, *Getting Schools Up To 21st Century Speed*, washingtonpost.com, 2013

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Endnotes

1. CDE surveyed 104 K-12 leaders and 111 higher education leaders in May 2015 for this report. Unless otherwise indicated, statistics included in the report are from this survey.
2. <http://www.centerdigitaled.com/higher-ed/Ohio-Colleges-Plan-to-Identify-Students-at-Risk-of-Dropping-Out-with-Data-Analytics-Tools.html>
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