Start Small with Big Data: 
Impactful Analytics for Higher Education

What exactly is big data? Agreeing on a universal description is nearly impossible. Intel, Oracle, The National Institute of Standards and Technology, Microsoft, and others have each declared their own “standard” definition (see Defining Big Data chart below). We all (mostly) agree on what “data” means. The issue seems to be with the “big” part. And like the phenomenon itself, the “big” seems to be expanding on a daily basis.*

“Pinning down what qualifies as big data—and whether it’s an educational panacea or a corporate-driven technological phase—is sure to be at the center of educational technology discussions for years to come (Carter, 2013).” We may never agree on an exact definition, but one thing is clear: higher education institutions are collecting and have access to more data than ever before. And data-based decisions drive institutional effectiveness.

“The era of big data has arrived in higher education as IT becomes increasingly embedded in the process that comprises ‘going to college,’ such as course enrollment, classroom instruction, and student services. Of equal value, data about student journeys, successes, and failures can be captured to improve both individual and collective outcomes across all of higher education in useful ways (Soares, 2012).” Data warehouses and the cloud make it possible to collect and maintain massive records on your students, alumni, operations, pedagogical impact, competition, marketplace, and more. Today’s sophisticated analytics technology makes it easier than ever to sift through and find meaningful patterns in all that data. As a result, demand for evidence to guide and support decision-making is on the rise.

There are, however, no established best practices in higher education for what to measure or which measurement methodologies produce the most meaningful results. Schools are still learning how to harvest the power of the large quantities of data sets they collect daily. This paper provides guidelines and best practices for making impactful data-based decisions and identifies mistakes to avoid when handling big data on your campus.

* See Jenzabar Infographic: The Big in Big Data for Higher Education
Defining Big Data

**Gartner.** In 2001, a Meta (now Gartner) report noted the increasing size of data, the increasing rate at which it is produced and the increasing range of formats and representations employed. This report predated the term “big data” but proposed a three-fold definition encompassing the “three Vs”: Volume, Velocity, and Variety. This idea has since become popular and sometimes includes a fourth V: veracity, to cover questions of trust and uncertainty.

**Oracle.** Big data is the derivation of value from traditional relational database-driven business decision making, augmented with new sources of unstructured data.

**Intel.** Big data opportunities emerge in organizations generating a median of 300 terabytes of data a week. The most common forms of data analyzed in this way are business transactions stored in relational databases, followed by documents, email, sensor data, blogs, and social media.

**Microsoft.** “Big data is the term increasingly used to describe the process of applying serious computing power—the latest in machine learning and artificial intelligence—to seriously massive and often highly complex sets of information.”

The **Method for an Integrated Knowledge Environment** open-source project. The MIKE project argues that big data is not a function of the size of a data set but its complexity. Consequently, it is the high degree of permutations and interactions within a data set that defines big data.

The **National Institute of Standards and Technology.** NIST argues that big data is data which “exceed(s) the capacity or capability of current or conventional methods and systems.” In other words, the notion of “big” is relative to the current standard of computation.

Source: MIT Technology Review, 2013

Big Decisions

Chances are you’re already employing the principles of business intelligence to make some of the more strategic operational decisions at your institution. Your Business Office relies on financial, student, and other institutional data to report on and manage processes. Therefore, it’s a natural shift to extend that kind of data-based decision making to all areas of your college or university, including the most critical area for success in today’s globally competitive environment—enhancing the student experience. By pulling information from the entire campus, combining it with outside data, and using technology to determine the “right data” to analyze and utilize, your school can easily begin asking (and answering) important questions like:

+ Based upon projections from degree plans, how prepared is our institution for future classes, faculty, facilities, and other needs?
+ What are the programs we should offer or drop to keep up with demand and expand our value to our constituents?
+ Are MOOCs right for us?
+ How can financial statements from previous years help us predict future budgets?
+ What is the actual return on investment for our advancement events and appeals?
+ What is being said about our school on social media and what are we adding to that conversation?
+ How do our continuing education, workforce development, online education, and/or schools of extension stack up against the competition?

+ Based on our institution-level mission and our students’ personal attainment goals, what are the best metrics to predict student success at our school?

**Data You Have Right Now**

The good news is that you already have a big pool of data to work with. The not-so-great news is, “although considerable amounts of data are being collected and stored (by higher education institutions), the data is not being used effectively to make predictions or trigger proactive responses (Bichsel, 2012).”

So, let’s start small with big data. What do you have to work with that you can easily access? Most institutions find that grouping data into two main categories—student data and institutional data—helps clarify the kinds of big, strategic questions it can address.

In the first bucket, if you are like most schools, you have ample data on your prospects, students, and alumni. With today’s interconnected and social-media driven world, you have a lot of information about what they are doing, saying, thinking, and buying.*

The second large bucket of data you have revolves around your own institution. Whether you use an enterprise resource planning (ERP) system to connect systems across your campus or are still operating in the “silo” world of disparate systems, you have ample information on what your institution is up to and how effective it is. That includes information and data collected from and reported to the local and federal government.

Examples of data you have access to right now include:

1. Data on your prospects, students, and alumni
   + Demographics
   + SATs, GPAs, transcripts
   + Course selection, registration, add/drop
   + Purchased/returned text books, library activity
   + Financial aid applications, employment to support education
   + Financials, fees, expenses (e.g., cafeteria)
   + MOOCs, online courses (data on how your students learn)
   + Social media
   + Internships
   + Alumni connections and post-CE job placements
   + Donations

* See Jenzabar Infographic: Social Media Engagement in Advancement
2. Data on your institution
   + Retention rates, graduation rates, transfer rates
   + Marketing statistics
   + Enrollment, yield rate
   + Advancement effort progress
   + Tenured faculty and adjunct
   + Classroom allocation
   + Instructional design effectiveness
   + Financials
   + Competitive information
   + National Center for Education Statistics, IPEDS

**Using Analytics to Drive Better Business Practices**

Now that you recognize the abundance of information you have, what can you do with it? Collecting and organizing data with a business intelligence (BI) analytic tool provides a clear view of what you are working with. Analytic tools offer common metrics for all of your datasets and give you the needed dashboards, reports, visualization options, and real-time monitoring that brings your data to life by making it understandable. With this new knowledge and ability you can empower every area of your institution to make better business decisions and achieve optimal performance. Some example areas where applying the basic principles of BI analytics to big data, even minimally, can have profound impact are:

**Improve institutional operations.** In an age when all of higher education is being asked to do more with less, analytics can help reduce costs by providing information needed for streamlining and refining business processes. “Many colleges and universities have demonstrated that analytics can help significantly advance an institution in such strategic areas as resource allocation, student success, and finance (Bichsel, 2012).” Powerful analytic tools allow you to study patterns of performance over time, from one semester to another or from one year to another. Armed with clear and accurate insight from data analytics, your institution can adopt better business practices and improve strategic planning across all departments.

**Enhance pedagogy and learning.** Computerized testing, tablets and other mobile devices, online learning, course management/learning management systems, and other educational technologies are giving rise to a new era of learning analytics. Using real- or near-real-time monitoring of student activity—such as postings on discussion boards, class material downloads, assessment results, wiki activity, and the many other transactions per student per course—faculty can more easily create optimal learning environments and continually refine pedagogics along the way.
In addition, data on faculty productivity can help drive positive learning outcomes. “Measuring faculty productivity is understandably a sensitive and controversial topic, but there is increasing acceptance that it is essential to sustainability. The issue here is largely cultural, rather than technology. However, the most successful institutions will employ technology to track, manage, measure, and improve faculty productivity. This faculty data will serve as a primary pillar of institutional analytics necessary to contain costs, exploit strengths, and sharpen the business model. Efficiently capturing data about faculty and their work—data such as accurate and timely lists of research publications—can be advantageous to both the institution and the individual faculty member (Thayer, 2014).”

**Increase student success.** Many colleges and universities now employ predictive analytics to improve their student success and retention rates. Best practices call for analyzing three years’ worth of historical data to find the risk factors and positive factors that inhibit or promote student success at an individual institution. Integrating data from multiple sources also improves at-risk student intervention efforts. These risk factors are different for every institution and will only be revealed by analyzing your existing data.

In addition, “Big data in the online learning space will give institutions the predictive tools they need to improve learning outcomes for individual students. By designing a curriculum that collects data at every step of the student learning process, universities can address student needs with customized modules, assignments, feedback, and learning trees in the curriculum that will promote better and richer learning (Guthrie, 2013).”

**Optimize advancement.** Effective fundraising is an essential component of any healthy institution. Most schools know that employing business analytics helps determine the true ROI on your advancement efforts. But getting a 360-degree picture of your constituents by aggregating data from a multitude of sources allows institutions to build deeper affinity and strengthen appeals. And most importantly, alumni have come to expect that personal touch.

In every area, it’s important to remember that the goal of analytics is to generate easy-to-understand information that facilitates better decisions, but people still make the decisions. Data-based decisions are best made by those that clearly understand the institution’s mission and goals and have expertise in a particular higher educational area. “What is needed most (in higher education) is investment in analytics professionals who can contribute to the entire process, from defining the key questions to developing data models to designing and delivering alerts, dashboards, recommendations, and reports (Bichsel, 2012).”
A Note about Privacy

While harnessing the power of data analytics is clearly a competitive advantage, schools that put strong security measures in place reduce their exposure to data misuse and abuse. A common mistake many institutions make when collecting and processing big data is not enforcing an institution-wide data security and privacy strategy. Technology puts power in hands of everyone, so it’s critical to restrict access to trained people who know how to properly handle it. Most institutional IT heads understand that sensitive internal data, such as student and faculty information, must stay private. As schools access personal data from multiple public and private outside sources—for example, collecting data on student ethnicity, family history, financial status, employment records, etc., to predict student success—the threat of egregious privacy violations increases. “Data breaches in higher education cost colleges an average of $111 per record according to a 2013 study (O’Neil, 2014).”

To reduce risk, best practices include establishing both user authentication verification and physical security to ensure material data is accessed only by those with appropriate permissions. Many schools are turning to cloud hosting to increase both data and physical security. Moving server hosting to a professionally managed datacenter with security layers eliminates much of the risk associated with theft. And outsourcing data operations to offsite location(s) helps strengthen access policies and user authentication procedures.

Go Ahead, Start Small

Applying analytics to big data is quickly becoming imperative for successful higher education institutions. “While big data and analytics are not panaceas for addressing all of the issues and decisions faced by higher education administrators, they can become part of the solutions integrated into administrative and instructional functions (Picciano).”

Even still, change is sometimes slow at many institutions. Using big data for impactful analysis on your campus can help with that problem, too. A recent EDUCAUSE study reported that “many study participants provided examples of how analytics programs can improve processes such as communication and decision making while increasing morale. … Analytics programs can foster communication between executive leadership, IR, and IT. This increased communications extends to functional-area leaders and reduces departmental ‘silioing,’ … Institutions should not wait for a cultural shift to be fully in place before beginning an analytics program. Initiating an analytics program may help establish that culture (Bichsel, 2012).”

Big data is here to stay. Facing unprecedented demands for accountability, efficiency, and effectiveness, modern colleges and universities need to use big data to identify and evaluate strategies for improving the student experience, ensuring institutional success in every area—from recruitment to alumni fundraising and everything in between. Higher education institutions that leverage the power of the large quantities of data at their disposal are better equipped to make impactful data-based decisions and thrive in today’s fast-moving and competitive higher education world.
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<thead>
<tr>
<th><strong>Strategic Question Examples for Higher Education Analytics</strong></th>
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<tr>
<td><strong>Admissions and/or Enrollment</strong></td>
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<tr>
<td>• What is being said about our school on social media and what are we adding to that conversation?</td>
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<td>• How are we doing overall for the upcoming semester/term/session?</td>
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<td>• How are we doing overall compared to past years?</td>
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<td>• Which programs, degrees, campuses, and/or segments of students need to be targeted as an alert to admissions and/or enrollment situation?</td>
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<td>• What location, gender, ethnicity, age, and/or other demographics can give a true picture of our incoming students?</td>
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<td>• How are we performing compared to projections for the upcoming semester/term/session?</td>
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<td>• How many students are obtaining the financial aid they need?</td>
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<td>• Based upon degree plans, how prepared is the institution for future classes, faculty, facilities, and other needs based upon projections from these plans?</td>
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<td><strong>Instruction</strong></td>
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<td>• How does student learning at our institution differ between in-classroom and online courses?</td>
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<td>• What do our learning outcomes tell us about our curricula design?</td>
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<td>• What programs should we offer or drop to keep up with demand and expand our value to our constituents?</td>
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<td>• How can monitoring student activity help us create optimal learning environments for our courses?</td>
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<td><strong>Retention</strong></td>
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<td>• What causes students to leave our institution?</td>
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<td>• Based on institution-level goals and individual or personal attainment goals, what are the appropriate metrics to measure student success at our school?</td>
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<td>• Which students are not attending class on a regular basis?</td>
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<td>• Which students are not doing well on assignments and tests?</td>
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<td>• How can assessment information be used to predict student success/failure?</td>
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<tr>
<td>• What location, gender, ethnicity, age, and/or other demographics can give a true picture of the students who are not succeeding/returning?</td>
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<td><strong>Finance</strong></td>
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<td>• How do expenses and revenue compare to the budget forecast at any particular point in time?</td>
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<td>• Which areas of the institution are spending more than budgeted and/or generating more revenue?</td>
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<td>• How can the financial statements from previous years be used to predict budgets for the future?</td>
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<td>• How can the institution analyze purchasing and work on cost-cutting initiatives?</td>
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<td><strong>Advancement</strong></td>
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<td>• What is the status of all campaigns?</td>
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<td>• Are gifts and pledges exceeding the trend from past years?</td>
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<td>• What is our most effective engagement time frame when working with major donors?</td>
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<td>• What designations, appeals, and/or solicitations are most effective?</td>
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<td>• Which demographic groups are responding to phonathons, emails, mailings, etc.?</td>
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<td>• What is the return on investment for different events and appeals?</td>
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Barb has been providing analytic professional services to higher education institutions for over 15 years with Jenzabar. Her areas of expertise include: business intelligence (BI) analysis, strategic and longitudinal reporting, executive dashboard design, data warehouse solutions, data conversion and mapping, analytic report requirement strategy, and IA Affinity ranking prediction design. She is a certified IBM/Cognos trainer and serves as an advanced report design instructor for Jenzabar Learning and Development. Prior to Jenzabar, Barb was a data specialist with Hiram College.

About Jenzabar

Jenzabar is a leading provider of enterprise software, strategies, and services developed exclusively for higher education. Our integrated, innovative solutions advance the goals of academic and administrative offices across the campus and throughout the student lifecycle.

Jenzabar's mission is to maximize our clients' success. Our award-winning software and experienced professionals provide our clients the tools and resources they need to thrive. As a trusted partner on more than 1,000 campuses worldwide, Jenzabar has over four decades of experience supporting the higher education community.

Bibliography


