

THINGS YOU SHOULD KNOW ABOUT... ANALYTICS

Scenario

Professor Donaldson teaches introductory chemistry at a large state university. An analytics program linked to the learning management system (LMS) helps him monitor the progress of the more than 500 students in this lecture class by compiling and analyzing information such as the number of times class notes are viewed, frequency of contributions to the discussion board, and quiz grades. From the application dashboard, Donaldson sees an indicator beside each student's name, reflecting the program's assessment of the likelihood that the student is on track to earn a C or better in the course—green denotes high likelihood, yellow suggests possible risk, and red indicates that, statistically, the student is at elevated risk. Donaldson can send e-mail to notify students if they appear at risk, congratulate them for work well done, or suggest ways to get more from the class.

In the third week of the term, Donaldson runs a diagnostic tool from the dashboard. The results show that for the past three years, the work of the 25 most active discussion-board contributors has correlated heavily with the top 25 class performers. Factoring in additional data, including scores on the departmental chemistry exam, Donaldson has quantifiable evidence that increased participation correlates with greater success in the course and with the subject in general. He sends e-mail notices to the top 25 discussion-board contributors, thanking them for their participation and underscoring that their efforts suggest ongoing success in the study of chemistry. He also e-mails alerts to students whose profiles suggest they might be at risk of not earning at least a C in the course, and he includes individual suggestions of campus resources and strategies that, according to data, correlate with better academic performance.

Kelly is pleased to receive a congratulatory note about her high level of discussion-board participation. Ben, who never had difficulty in high school, is surprised by the e-mail that says he may be at risk. At the same time, he admits he has felt overwhelmed by the transition to college, and he is relieved to know that his professor cares enough about his success to suggest action. Accordingly, Ben uses his dashboard to schedule an appointment with his instructor, and he looks over the list of options in the e-mail, deciding to attend the help sessions held in the university resource center. He also resolves to take an active role in the discussion board and in class, rather than simply watching the questions other students pose.

1 What is it?

Analytics tools provide statistical evaluation of rich data sources to discern patterns that can help individuals at companies, educational institutions, or governments make more informed decisions. In commercial usage, analytics software may evaluate data mined from purchasing records to allow a web-based retailer to suggest products that might interest customers or allow a search engine to target ads based on an individual's location and demographic data. Colleges and universities can harness the power of analytics to develop student recruitment policies, adjust course catalog offerings, determine hiring needs, or make financial decisions. In a teaching and learning context, data from such sources as the learning management system, college application forms, and library records can be used to build *academic* analytics programs that use algorithms to construct predictive models that can identify students at risk for not succeeding academically.

2 How does it work?

Most colleges and universities collect and store vast amounts of data—in the LMS, admissions files, student and library records, and other systems. Analytics applications can mine at least some of this data, subject it to statistical analysis, and prepare reports or data visualizations to reveal patterns, trends, and exceptions. Some algorithms may set triggers that invoke specific action, such as sending a note about tutoring options to a student deemed to be at risk or a congratulatory e-mail to one whose work shows improvement. Academic analytics programs can offer information both at the course level and the programmatic level. This information might take the form of a dashboard, where students view their own standing relative to the benchmarks that the system correlates with academic success. From there, students can deduce where and how action should be taken to improve their educational record. For all such applications, the goal is to improve student achievement, retention, and graduation rates and to demonstrate institutional accountability by offering students who may need additional help the information they need to obtain it.

3 Who's doing it?

A growing number of academic institutions frequently use analytics to evaluate and support academic performance. At Purdue University, the Signals program tracks student progress, providing real-time information about their standing in a course and directing them to university support programs. At North Carolina State University, data from university records and individual questionnaires are used to predict academic performance of students in their critical first year. At Drexel University, the Blackboard Vista STAR Report combs through the LMS to track metrics on student engagement (log-ins) and assessment

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elements. Researchers at the University of Wollongong use a tool called Social Networks Adapting Pedagogical Practice (SNAPP) to analyze student posts and interaction on the discussion boards to try to identify students at greater risk. Finally, a number of colleges and universities employ commercial applications like the one from Starfish Retention Solutions, which draws data from course management systems and student records to identify at-risk students and suggest recourse to them.

4 Why is it significant?

Large stores of data already exist at most colleges and universities. By analyzing this data, analytics applications have the potential to provide a predictive view of upcoming challenges, both for the institution and for students. The resulting data-driven decisions can support optimal use of both economic and pedagogical resources while offering a structure for improved educational outcomes. Because research suggests that students who are able to successfully transition from high school to college are more likely to graduate, many institutions focus their resources on this critical year, and here analytics applications can help identify where and when resource investments will have the greatest benefits. The use of such technological tools opens a window into students' interaction with content, peers, and instructors, as well as presenting an opportunity to measure those interactions and draw conclusions about what they mean for student retention and success.

5 What are the downsides?

Both data mining and the use of analytics applications introduce a number of legal and ethical considerations, including privacy, security, and ownership. On one hand, institutions might be vulnerable to charges of "profiling" students when they draw conclusions from student data; on the other, they could be seen as irresponsible if they *don't* take action when data suggest a student is having difficulty. The best results emerge when an institution has cross-system participation from multiple data sources such as library records, an LMS, registration information, and student applications. But even then the best evaluative algorithms can result in misclassifications and misleading patterns, in part because such programs are based on inferences about what different sorts of data might mean relative to student success. Further, while analytics is correlative, it doesn't denote causation—something that could send a mixed message to students who might believe that if they participate in a class "at the right level," they will receive a good grade, irrespective of how much they learn. Even where specific activity correlates with success, it's not always clear what interventions will be most effective at informing students who appear to be at risk and persuading them to take action. For many institutions, finding the resources for normalizing and warehousing data and the expertise to set up a robust analytics system can be challenging. As learning tools and resources move into the cloud, the ability to incorporate that data into an analytics program will depend on policies and technical means to share information across organizations.

6 Where is it going?

The concerns raised by analytics programs will likely decrease as new tools are developed and as institutions are forced to cope with greater financial constraints that will make the careful targeting of available resources increasingly important. As best practices emerge, the use of analytics on campuses will demand new control paradigms for accessing information mined from student records, and privacy and security will need to be continually reevaluated. A broader range of data sources should emerge, something of particular importance if colleges and universities move away from LMS tools. Clicker data, in-class discussion tools, e-portfolios, or ad hoc questionnaires executed in real-time during class could be incorporated into analytics algorithms and predictive models, broadening the effectiveness of the tools. Students could benefit from data compared across classes for the same course—or even across institutions because such data could reveal links between teaching styles and student learning success.

7 What are the implications for teaching and learning?

The effectiveness of any analytics tool depends heavily on the frequency and character of faculty and student use. Careful and cautious interpretation of data is vital: patterns revealed by the data for small cohorts of students might not apply to other cohorts or to larger groups of students. At the departmental level, patterns might confirm program strengths or suggest resource deficiencies. On the institutional plane, predictive models can help align resources such as tutorials, online discussions, and library assistance with student need. For the individual student who uses a dashboard to track personal progress, analytics can be a valuable tool for self-assessment and a powerful component of a personal learning environment. Analytics tools might facilitate better communication between faculty and students while empowering students to monitor their coursework and take greater responsibility for their learning. As students, faculty, and instructional designers become more aware of the potential of analytical tools, we may start to see tools and LMS plug-ins that are designed specifically to generate meaningful analytics.

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