Information Technology Research And Planning Monograph Series

Analytics and Business Intelligence

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It seems like it's everywhere – data-driven decision making; or, more formally, analytics and business intelligence (BI). In Ohio alone, we have the Educational Management Information System (EMIS), the Ohio Teacher and Principal Evaluation Systems (OTES & OPES), the Ohio Improvement Process Model (OIP), the state report cards and more. Analytics and BI is here – and they are growing.

> *"In the ed-tech industry, big data and analytics are everywhere. Companies ranging from Khan Academy to Pearson collect and analyze reams of information on how millions of students interact with digital content. Other companies promise to help district administrators use big data to predict everything from which candidates for teaching jobs are likely to have the biggest impact on student-test scores, to where population growth will require that new school buildings be built in the future." (1)*

> *"According to Stratistics MRC, the Business Analytics Market is estimated at $44.5 billion in 2015 and is expected to reach $71.1 billion by 2022, growing at a CAGR of 6.9% from 2015 to 2022." (2)*

ANALYTICS IS NOT ONLY HERE; it's big business.

But what about analytics information? And what's the difference between business intelligence and analytics?

> *"BI is a comprehensive term that refers to analytics and reporting tools that were traditionally used to determine trends in historical data...The key distinction between analytics and BI is that the latter actually presents the insights determined by the former in reports, dashboards or interactive visualizations." (3)*

Distinctions aside, most districts are more invested in analytics and BI than they realize. Besides the large state-provided datasets, if your district uses any sort of dashboard then you're already using data to make decisions.

> *"More than half the respondents to our 2016–17 Digital School Districts Survey said they use decision-making dashboards, and another 23 percent are developing them. The most common functions are tracking student performance and information. Accountability dashboards are less common, but the number is likely to grow as the Every Student Succeeds Act takes effect." (4)*

Ohio's state education report cards are one example of business intelligence. They present the information gleaned from the analysis of datasets (the analytics) deemed important by the state legislature and the Ohio Department of Education. Ever since the reports began, there has been on-going controversy about what data is collected and what it really says about school district performance.

As the importance of the state report cards have grown, we need to be sure that we're asking the right questions and collecting the right data. Just as important, what are we doing with the data and BI when we get it?

There are two main areas where analytics and BI are typically applied in schools; measuring student achievement and performance and district business performance.

STUDENT PERFORMANCE

Most student performance measures provide summative data about groups and/or individual students. Digging deeper, it's possible to uncover information about what specific knowledge and skills students struggled to learn and understand, but analysis can go further still.

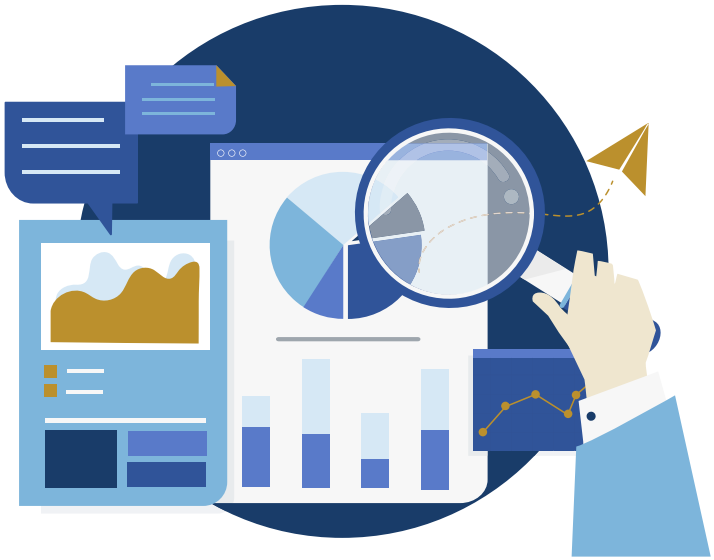
Analytics can tell us why individual students struggled with the knowledge we presented and the skills we asked them to master. Having this level of granularity is invaluable because knowing why students performed as they did provides the prescription for change.

For example, in the landmark research done by John Hattie and presented in "Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement," the strategy "feedback" was ranked number 10 overall with an effect size of 0.73. This value was derived from 1,287 research studies involving 67,931 students.

> *He found, "When teachers seek, or at least are open to, feedback from students as to what the students know, what they understand, where they make, and when they have misconceptions and when they are not engaged – then teaching and learning can be synchronized and powerful. Feedback to teachers helps make learning visible." (5)*

> *For analytics to be truly effective, it should provide the right data at the right time. As EdWeek stated, too often "…such reports often represent aggregate views of student and school data devoid of the deep visualizations that are critical to strategic and tactical judgments." (6)*

Assuming teachers have the BI when they need it, and adjust instruction accordingly, then the summative student achievement results in end-of-year reports will reflect improved student performance and achievement. For this to happen, tools to conduct the analysis must be in place and teachers must be trained how to effectively adjust teaching strategies in real-time, resulting from the analysis.



BUSINESS PERFORMANCE

Analytics and business intelligence have a significant role to play in improving business performance too. Let's look at two examples.

Many districts have automated their substitute teacher fulfillment process using online software like Aesop™. In doing so, many district administrators will report they believe the move to this system has reduced the time it takes to post and fill a vacancy. In addition, many will report they believe that the number of classes not covered by a substitute teacher has been reduced.

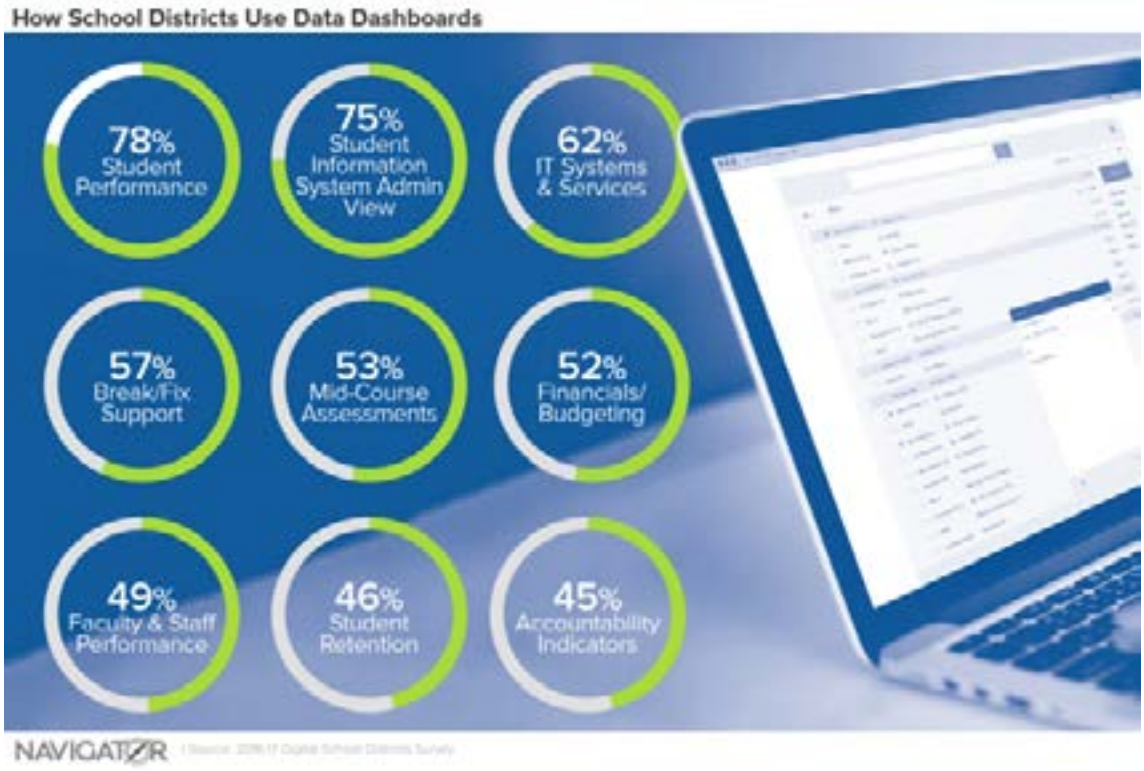
But do districts have the data to support that belief? It's an easy thing to pull reports on the posting/fulfillment metric. Further analysis would reveal how many less unfilled classes occurred from this year to prior years, and depending on how the system is managed, it may save the district significant clerical costs if the district reduces FTE's instead of absorbing that position back into the clerical pool.

Collecting this data and understandings its impact on the district would enable the leadership team to demonstrate fiscal accountability at a time of increasing scrutiny of school district budgets and management efficiencies.

Fees processing is another area where districts can apply analytics and BI to improve district business performance. Many districts struggle with large uncollected student fees. Often, the only time administrators become aware of the problem occurs when students transition from one building to another or during the spring of their senior year when counselors review grades, credits and outstanding fees – anything that might prohibit a student from graduating on time.

But if analytics and BI were applied to the problem, a clearer picture could emerge sooner, allowing districts to respond. Detailed reports of outstanding fees could be run each semester. The reports could examine the data by sub-groups of grade, longevity in the district, economic status, number of students per household, etc. Armed with this level of information, districts could develop and deploy intervention strategies on a case-by-case basis that should lead to greater student fees collection.

How else are analytics and BI being used in American schools? The 2016-2017 Digital School District Survey cited above suggests some examples. (7)



While the graphic above does not provide details on how the analytics and BI are done, it does show how widespread their adoption has become in our schools. Nor does the survey tell us the efficacy of these applications. In fact, both businesses and schools report problems with effective analytics and BI deployment.

> *"The problem, however, is that the adoption of analytics is being hindered not by technology, but by age-old people problems: change management and cultural resistance." (8)*

> *"Here are the top obstacles to widespread corporate adoption and use of analytics (up to three answers were accepted): (9)*

38 percent: Lack of understanding of how to use analytics to improve the business

34 percent: Lack of bandwidth due to competing priorities

28 percent: Lack of skills internally in the line of business

23 percent: Existing culture does not encourage sharing information

SO, WHAT DO WE DO?

In study after study the reports are clear – people are the problem. So how do we get people to be the solution and enable schools to adopt effective analytics and BI as they are more successful? A seminal article in EdWeek provides an in-depth plan for moving forward.

1. Data tools must be able to pinpoint the strengths and weaknesses of districts, schools, classrooms, students, grade levels or teachers. Such findings require deep insights into the teaching and learning activities taking place in the organization.

2. District and school leadership teams must have immediate access to every data point necessary for teaching, learning and accountability.

3. The data must reveal patterns and opportunities for student and/or school growth. Because it is possible for students to improve their test scores without demonstrating growth in their content knowledge or academic skills, it is imperative that practitioners be able to see whether students are simply improving their test scores or truly learning more – and better. To do this, the data must reflect engagement and performance over an extended period of time.

4. To make informed judgments about teacher effectiveness, student achievement and growth, data must be linked to teacher evaluation and professional development needs. The data must allow analyses of instructional strands from formative assessments. This enables teachers who need support to get what they need to strengthen their pedagogy and content knowledge.

5. Administrators and teachers must be able to make easy and quick correlations, conduct cross-referencing and access comprehensive student profiles in an on-demand, data-rich environment. When a new data point becomes available, it must be accessible to educators quickly (within 24 hours) for there to be any hope of using instructional and developmental time well.

6. There must be ways to present historical and trend data in various motifs – graphs, matrices; aggregated and disaggregated. The lessons embedded in historical and trend data often help explain current conditions and performance. The visualized data must allow for queries that can be answered by mining various data fields.

7. The data must elevate conversations with and between stakeholders. Assumptions and feelings must be informed by real-time analyses of relevant data.

8. Teachers and administrators must be empowered to do the data mining that is critical to student achievement and growth. Information technology professionals must focus on data fidelity, end-user support and technology infrastructure instead of being confined to managing data and generating reports with marginal utility.

9. Real-time data mining must support the development of strategies and tactics to close achievement gaps. Queries about the data on individuals or groups are essential to understanding achievement gaps and what might be done to eliminate them. Correspondingly, all objectives to improve achievement must be informed by highly nuanced data.

10. Effective teaching must be the object of analyses of observations and evaluations, which would have to be anchored in timely qualitative and quantitative data.

11. Analytics should modernize and transform the use of student-information systems from static warehouses to information resources. The goal is to get data into the hands of those working in schools and classrooms. To build meaningful, personalized learning experiences from data, educators must have a deep understanding of every student's circumstances – including academics, behavior, demographics, history and growth and development." (10)

ENDNOTES:

(1) https://www.edweek.org/ew/articles/2016/01/13/the-future-of-big-data-and-analytics.html
(2) https://www.reuters.com/brandfeatures/venture-capital/article?id=12037
(3) https://www.dataversity.net/distinguishing-analytics-business-intelligence-data-science/
(4) https://blog.erepublic.com/schools-struggle-with-analytics-7f8d759242a8
(5) John A. C. Hattie, Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement, (New York, Routledge, 2009), 173.
(6) https://www.edweek.org/ew/articles/2014/10/15/08hamer.h34.html
(7) https://blog.erepublic.com/schools-struggle-with-analytics-7f8d759242a8
(8) https://www.itworld.com/article/2751673/business-intelligence/biggest-barrier-to-business-analytics-adoption-people.html
(9) https://www.cio.com.au/article/367783/biggest_barriers_business_analytics_adoption_people/
(10) https://www.edweek.org/ew/articles/2014/10/15/08hamer.h34.html

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