# 19 Times Data Analysis Empowered Students and Schools

Which Students Succeed and Why?





**BY ELANA ZEIDE** 

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## 19 TIMES DATA ANALYSIS EMPOWERED STUDENTS AND SCHOOLS WHICH STUDENTS SUCCEED AND WHY?

BY ELANA ZEIDE | FUTURE OF PRIVACY FORUM

Thoughtful use of education data has tremendous potential to improve and address inequities in America's education system. Scientists better understand how the brain incorporates new information and skills. Educators have a more accurate sense of student progress and potential risk for dropping out. Students and teachers use more detailed information about their strengths, weaknesses, and individual academic performance to diagnose and address learning gaps. Schools can correlate patterns with failing or dropping out, and intervene early with at-risk students. Districts and schools can use data to allocate resources and create institutional reform to better meet student needs in a world where students take increasingly personalized or non-traditional paths to graduation.

Today, across other industries, companies use new technologies and analytical approaches to provide more personalized services to customers; municipalities streamline allocation of city resources; and doctors can make more precise diagnoses. Until recently, educators did not have much information available to generate new insights about the learning process, student success, or optimal institutional management. However, education–both K-12 and higher ed–is now catching up as newly created digital learning tools and platforms generate an abundance of highly detailed data that can help parents, teachers, administrators – and ultimately students – make more informed choices.

With this data, we can finally observe patterns during instruction, across classrooms, between schools, and over time to create a more complete understanding of which students succeed and why. The ability to compare administrative, academic, demographic, and social information from various sources at last provides a means to examine the full multiplicity of factors that contribute to student success. Examining student trajectories over time shows how well students are prepared for the next steps in the learning process. They can identify ways to facilitate application and transition between school levels and into the workforce.

To provide useful insights, research about long term education and career success often requires sharing information—sometimes

including sensitive data—across schools, between states, and over time. The student data used in this research must be collected, used, and deleted with sufficient privacy protections. Appropriate policies, well-tailored laws, best practices, and genuine enforcement mechanism minimize the privacy risks, and ensure the best outcomes for students.

This report highlights the ways that newly available technology, data, and analytical techniques can create better educational outcomes. It presents concrete examples from Pre-K through higher education of how education data can be used to benefit students, the education system, and society-at-large. The cases here illustrate how students, educators, researchers, and advocates apply data analysis to encourage student success and retention, facilitate more effective instruction, advising, and administration, and ameliorate inequalities. Data-driven education has the potential help bridge the achievement, retention, and discipline gaps so that all students can enjoy a high quality education and achieve career success.

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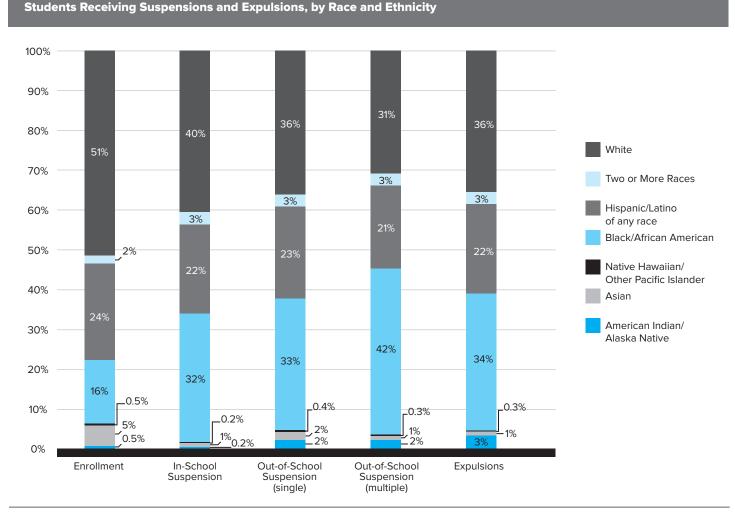
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### I. PRIMARY AND SECONDARY EDUCATION

#### 1. Equal Justice for All

#### (Nationwide Public Preschool, Primary & Secondary Schools)

Data analysis exposed how zero tolerance discipline policies disproportionately affected minority students in practice, prompting a paradigm shift in schools nation-wide. Based on information collected through 2012 on up to 49 million students, the U.S. Department of Education's Civil Rights Data Collection (CRDC) revealed that, across all age groups, black students were suspended and expelled at a rate three times greater than white students. The CRDC began collecting much more detailed information in 2009-10, including data on school discipline, that allow analysis of outcomes according to student subgroups. With this new scope of information, the data showed a striking disparity in preschool suspension: while black children make up 18 percent of preschoolers, they account for more than 40 percent of out-of-school suspensions. The pattern continues throughout primary and secondary education with 16% of blacks students being suspended compared to only 5% of white students. This information prompted the U.S. Secretary of Education and Attorney General to issue formal recommendations promoting more thoughtful and fair school discipline, which districts have been implementing with significant success.



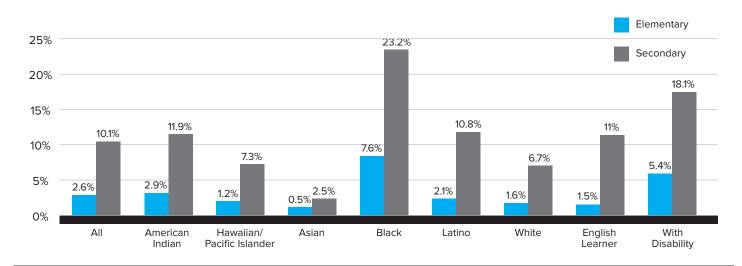
Source: Data Snapshot: School Discipline, Civil Rights Data Collection, U.S. Dept. of Educ. Office for Civil Rights, Issue Brief No. 1 (March 2014), available at http://ocrdata.ed.gov/Downloads/CRDC-School-Discipline-Snapshot.pdf.

#### 2. Sending Kids Home – Means They Might Not Come Back

#### (Nationwide Primary and Secondary Public Schools)

Critics have long challenged suspension-oriented disciplinary policies as counterproductive to improving student performance and reducing racial inequities. Until recently advocates and researchers struggled to support these claims with empirical proof because they had to rely on school and district level data that did not capture post-suspension outcomes. Today, they can finally examine how suspension affects students' behavior and trajectories by combining combine longitudinal and administrative data.

In 2014, researchers from the Center for Civil Rights Remedies analyzed information from across the United States, including student K-12 suspensions, self-reported delinquency, arrest, and incarceration records to demonstrate that high suspensions did not improve school outcomes or deter future misbehavior. Instead, they found that students suspended from school are less likely than their non-suspended peers to obtain a high school diploma and to obtain a bachelors degree by their late 20s, and are more likely to be arrested, become multiple offenders, and be sentenced to confinement in a correctional facility. These findings contributed to the nationwide reevaluation of "zero tolerance" school discipline policies, culminating in the Obama administration advising schools to find alternatives to policies that promote suspension.



Elementary and Secondary Out-of-school Suspension Rates by Subgroup, 2011-12

Source: Daniel Losen et al., *Are We Closing the School Discipline Gap*?, K-12 RACIAL DISPARITIES IN SCHOOL DISCIPLINE. The Center for Civil Rights Remedies (Feb. 2015), http://civilrightsproject.ucla.edu/resources/projects/center-for-civil-rights-remedies/school-to-prison-folder/federal-reports/are-weclosing-the-school-discipline-gap/AreWeClosingTheSchoolDisciplineGap\_FINAL221.pdf; Tracey L. Shollenberger, *Racial Disparities in School Suspension and Subsequent Outcomes*, Center for Civil Rights Remedies and the Research-to-Practice Collaborative (2013), http://civilrightsproject.ucla.edu/ resources/projects/center-for-civil-rights-remedies/school-to-prison-folder/state-reports/racial-disparities-in-school-suspension-and-subsequent-outcomesevidence-from-the-national-longitudinal-survey-of-youth-1997/Shollenberger\_racial-disparities-suspension-draft.pdf.

#### 3. Drawing a Map – From Poverty to Performance

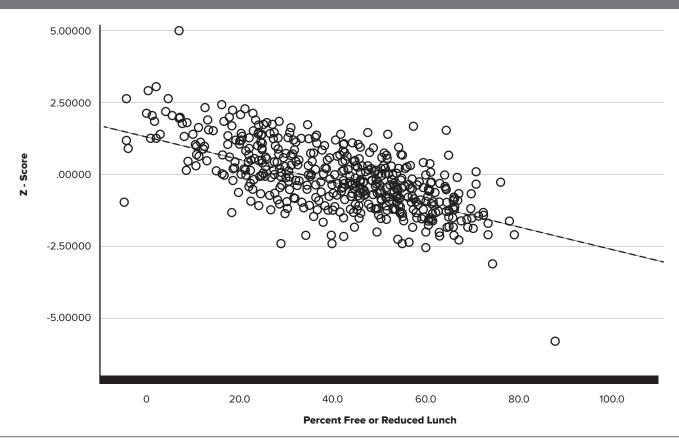
#### (Maine Public Schools)

By analyzing a larger number of variables from multiple sources, researchers can expose inequities to close the achievement gap. At the direction of the state legislature, the Maine Education Policy Research Institute (MEPRI) at the University of Southern Maine used school data to examine how a broad array of factors in primary and secondary public schools correlate with better student performance. Researchers compared the different characteristics associated with schools that had high or low levels of students qualifying for free or reduced lunch programs and average student performance on the New England Common Assessment Program (NECAP).

They found that while both categories had similar student-to-

teacher ratios, the teachers in schools serving poorer students had less experience and education compared to those with wealthier pupils. The Institute's 2014 report showed that specific factors like school size and per pupil expenditures did not correlate as strongly as the predominant income level of the school student body. Indeed, the level of poverty in a school was "the single best predictor of average student performance." The data also revealed that the levels of poverty found in schools not only affected children from poorer homes but also their classmates. Wealthier students in higher poverty schools did not perform as well as their peers attending schools with more generally affluent student populations. The Maine legislature is now using this research to craft more effective reform.

#### **Correlation Between Poverty and Achievement for All Schools**



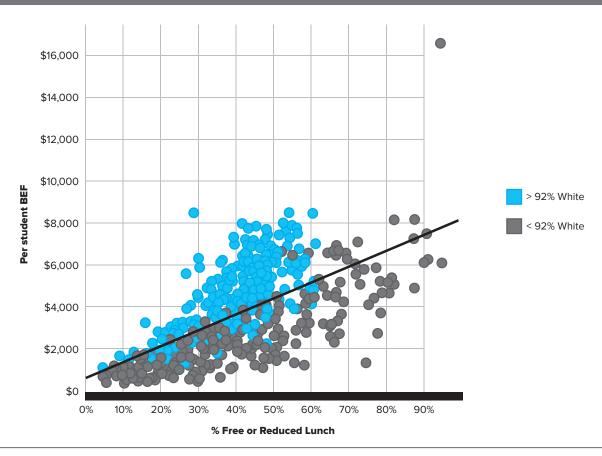
Source: David L. Silvernail et al., *The Relationships Between School Poverty and Student Achievement in Maine*, Maine Education Policy Research Institute, University of Southern Maine (Jan. 2014), https://usm.maine.edu/cepare/relationships-between-school-poverty-and-student-achievement-maine.

#### 4. Spending Taxpayer Dollars Wisely

#### (Pennsylvania Public Schools)

Data helps advocates expose and address inequities. In 2014, data analysis exposed inequitable distribution of basic education funding in Pennsylvania, which was one of only a few states that did not use a fixed formula to allocate funding among public school districts. The state instead enacted a new funding formula each year during its annual budget process. Through an analysis of publicly available data about enrollment, demographics, and basic education funding in 501 districts, an independent advocate revealed that the state spent dramatically more per student in districts with predominantly white populations compared to economically similar districts with more racial diversity. Prompted by these findings, a new Basic Education Funding Commission found that the existing system created an unbalanced funding distribution that does not match the cost of providing for students' needs based on the specific district, given programs offered and populations served. In June 2015, the Commission recommended that Pennsylvania shift to a more proportionate and equitable formula-based funding that takes into account relative wealth, local tax effort, geographic price differences, enrollment levels, and local support, among other factors.

#### **District Per-Student BEF vs. Poverty**



Source: David Mosenkis, Racial Bias in Pennsylvania's Funding of Public Schools, Power Philadelphia (11-13/14), http://www.powerphiladelphia.org/blog/racial-bias-in-pennsylvanias-funding-of-public-schools.

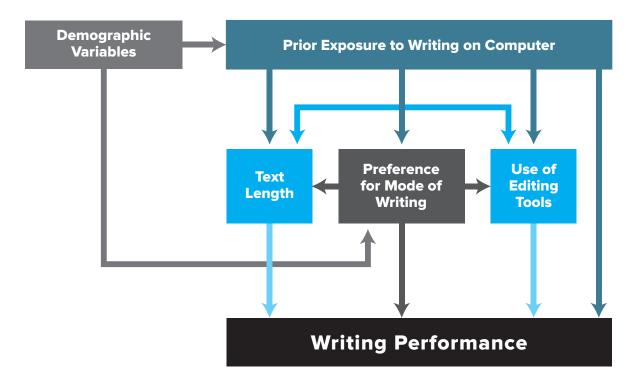
#### 5. Too Much Screen Time is Bad; Too Little Might Be Worse

#### (Nationwide Fourth Graders)

Analyzing data can expose ways that integrating technology into classrooms might unexpectedly and disproportionately affect student outcomes and assessment. A new study by the U.S. Department of Education's National Center for Education Statistics suggests that the classroom and homework shift from pen and paper to computers and tablets may put students without access to the Internet outside of school at an increased disadvantage.

As of 2014, more than half of U.S. states used computers to administer writing tests to students beginning in third grade. In 2012, the National Assessment of Educational Progress (NAEP) examined the writing performance of nationally representative sample of 10,400 fourth graders from about 420 public and 90 private schools to determine how well they could demonstrate their writing ability on computers. Researchers also compared the results to similar assessments conducted using pen and paper in 2010.

Students who did not have access to the Internet home - and who therefore had less experience looking for information on the Internet and writing to friends and family online – wrote significantly shorter essays and did not use editing functions like spell check and backspace. High-performing students scored better on computers, while low- and middle-performing students fared worse. The research suggests that students with less familiarity with computers devote more cognitive resources and time to entering information on keyboards and navigating digital menus with less time and focus to organize and communicate ideas. This may disproportionately affect minorities, poor students, or English language leaners who generally are less likely to have home Internet access.

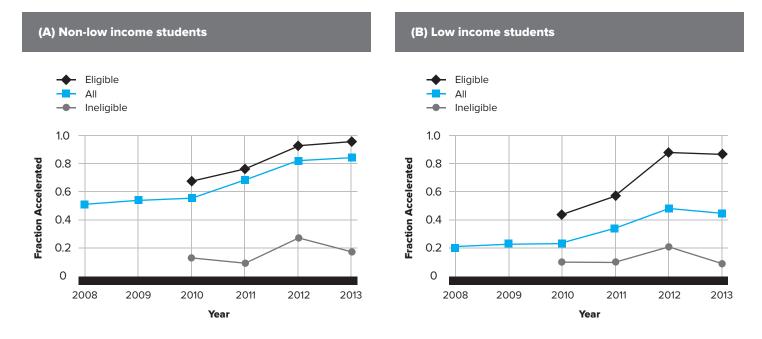


Sources: Jill Barshay, Using computers widens the achievement gap in writing, a federal study finds, THE HECHINGER REPORT (Jan. 11, 2016), <a href="http://hechingerreport.org/online-writing-tests-widen-achievement-gap/">http://hechingerreport.org/online-writing-tests-widen-achievement-gap/</a>; White, S., Kim, Y., Chen, J., and Liu, F. Performance of fourth-grade students in the 2012 NAEP computer based writing pilot assessment: Scores, text length, and use of editing tools (NCES 2015-119), National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education (October 2015), http://nces.ed.gov/nationsreport.org/subject/writing/pdf/2015119.pdf.

#### 6. Fair for One; Fair for All

#### (Wake County Public School System)

All students should get a fair evaluation for an equal opportunity to advance their academic careers. Wake County Public School System (WCPSS) in North Carolina sought to increase the disproportionately low rates of enrollment in advanced math classes among female, black, Hispanic and low-income students. In the 2010–2011 school year, the district decided to use masked performance data, rather than teacher recommendations, to determine student eligibility for these courses. Administrators used information from a variety of sources, including students' middle school grades and their performance on standardized tests, to create a model predicting which sixth, seventh, and eighth graders would succeed in advanced math. Teachers were surprised when the model identified many students who had not been considered promising candidates for advancement. By promoting pupils based on this data, rather than on intuitive decisions, the district substantially improved overall rates of math acceleration among black, Hispanic, and low-income students, and raised female math acceleration to reflect their proportional enrollment in the district – all without impacting the successful completion rates. Wake Forest Middle School, for example, tripled the number of eighth-graders taking algebra, and maintained a 97 percent pass rate on state exam.



Source: Shaun M. Dougherty et al., Middle School Math Acceleration and Equitable Access to Eighth-Grade Algebra Evidence From the Wake County Public School System, 37 EDUCATIONAL EVALUATION AND POLICY ANALYSIS 80S (2015), http://epa.sagepub.com/content/37/1\_suppl/80S.

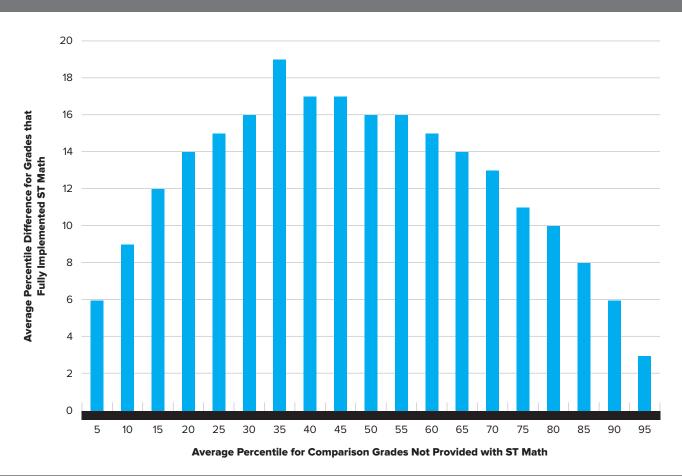
#### **II. SECONDARY EDUCATION**

#### 7. Understanding the Brain, So Students Can Understand Math

#### (ST Math Programs in California Public Middle Schools)

Neuroscience research at the University of California, Irvine, found that the brain's ability to hold visual representations in short term memory and project how those representations will evolve in space and time is crucial for understanding math. However, traditional math classes generally do not develop this Spatial-Temporal (ST) reasoning, instead relying on language-based approaches like equations, word problems, and symbols. Using this insight the MIND Research Institute developed a math-learning program, Spatial-Temporal Math (ST Math) that relies on visual components to boost math comprehension and proficiency. In 2014, a study found this program to be a success. Including more than 19,980 second through fifth grade students in lower-performing California schools, researchers found that students in grades who had fully implemented the program scored significantly higher (an average of 6.32 percent) than their peers. The program also improved schools' statewide rankings, so that a school at the 50th percentile statewide would move up 16 percentile points in statewide ranking after implementing ST Math for one year.



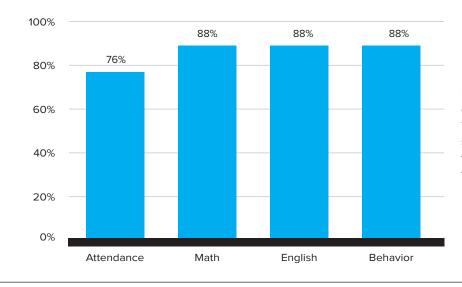


Source: Andrew Coulson et al., Evaluation of the MIND Research Institute's Spatial-Temporal Math (ST Math) Program in California (2014), http://www.wested.org/wp-content/files\_mf/1415393677Evaluation\_STMath\_Program\_20141107.pdf.

#### 8. Catch a Falling Student

#### (Nationwide Urban Secondary Schools)

Research has shown that factors such as poor attendance, poor behavior, and course failure measured as early as middle school predict a student's likelihood of dropping out of high school. The Diplomas Now partnership, formed by the Talent Development Secondary, City Year, and Communities In Schools organizations, gives teachers biweekly reports on students' attendance, behavior, and course performance in reading and math. The program started in one Philadelphia school in 2008, but now is in over 30 schools nationwide. Using predictive modeling, the system highlights students whose information indicates a greater risk of dropping out so that teachers can personally intervene with struggling students earlier than with traditional warning signs. Looking at the aggregated data over time provides predictive analytics – what present factors most strongly predict future outcomes. During the 2013-14 school year, the program reduced absenteeism by 44 percent, suspensions by 59 percent, students failing English by 57 percent, and students failing math by 58 percent. For example, at the South High School in Columbus, Ohio reading scores on the Ohio Graduation Test increased by 31.8 percent to 73.6 percent. Writing scores increased by 29.6 percent to 71.4 percent. The program produced similar results in two schools in Tulsa, Oklahoma, ending 2015 with a 51 percent reduction in number of students with poor attendance; an 80 percent reduction in number of suspended students; and an 83 percent reduction in number of students failing math, and an 88 percent reduction in number of students failing English.



#### **Diplomas Now**

Diplomas Now helps all students end the year on track to graduation. This represents the percentage of students in Diplomas Now schools who were on track by the end of the 2014-2015 school year.

Sources: Our Impact | Diplomas Now, http://diplomasnow.org/our-impact/; Andrea Eger, *Tulsa education conference: National expert Robert Balfanz addresses high school dropout problem*, TulsaWorld (July 8, 2015), http://www.tulsaworld.com/news/education/tulsa-education-conference-national-expert-robert-balfanz-addresses-high-school/article\_4d3f5f92-fc0c-526d-b3d8-3267a11bf629.html; William Corrin et al., *Laying Tracks to Graduation: The First Year of Implementing Diplomas Now.* MDRC (2014), http://eric.ed.gov/?id=ED546638; William Corrin et al., *The Diplomas Now Model of School Reform: Interim Impact Findings from the Investing in Innovation* (i3) Evaluation (working title), MDRC (forthcoming 2016).

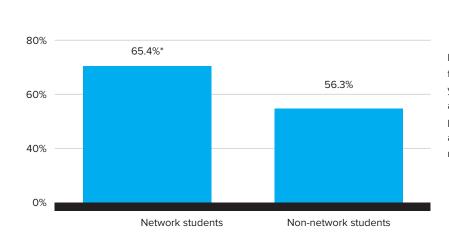
#### 9. Kids Need More Than "Just the Facts"

#### (Low performing Public Middle Schools)

Recent research on retained learning suggests the importance not just of learning specific skills or information but also "deeper learning" that focuses on critical thinking, communication, collaboration, academic mindsets, and learning how to learn. Critics have previously suggested that the rigor of deeper learning curricula only worked for already high-achieving learners. However, by studying thirteen schools in California and New York with a higher proportion of low-income and English-language learners, researchers found that deeper learning instruction promoted on-time school graduation and increased four-year college enrollment for lower achieving populations as well. According to data collected about students entering the ninth grade from 2007 to 2011, pupils in deeper learning schools scored higher on reading, math, and science and were 9 percent more likely to receive their high school diploma within four years than those in comparable schools. While deeper learning and comparison schools had similar overall rates of enrollment in postsecondary institutions, those from deeper learning programs were more likely to enroll in four-year or selective institutions.

#### **Percentage of Students Graduating High School**

100%



Percentage of students graduating from high school within four years of entering grade 9 among students who attended participating network high schools and similar students who attended non-network high schools.

Note: The percentage for network students is the unadjusted percentage while the percentage for non-network students is the adjusted percentage. \* Difference between network and non-network students is significant at the 0.05 confidence level.

Source: K. Zeiser et al., *Evidence of Deeper Learning Outcomes*, American Institutes for Research and The Research Alliance for New York Public Schools (2014) http://www.air.org/sites/default/files/downloads/report/Report\_3\_Evidence\_of\_Deeper\_Learning\_Outcomes.pdf.

#### 10. Brains Work Better With Some Heart and Soul

#### (California Public Schools)

Education advocates have long claimed that it is important to take the "whole child" into account when evaluating students. Recent research supports this claim: a field test in some of California's largest schools districts that involved over halfa-million students in Spring 2015 had preliminary findings indicating that students at schools with higher social-emotional and culture-climate performance scored better in terms of individual academic performance.

Using predictive analytics, researchers found that middle school students' self-management skills and high school students' growth mindsets were the most predictive factors for academic performance at the next level. Analysis also revealed some schools with markedly above average Index results, despite serving a population including at least threequarters of students in poverty. With further study, researchers hope to identify the factors that promote such success.

Some of California's largest school districts are using big data to creative an alternative accountability designed to ensure not only academic performance but also that all students have a quality school environment. Working with researchers at Stanford University's John W. Gardner Center for Youth and Their Communities, eight of the largest districts in California are implementing a new assessment tool that takes these non-academic factors into account. In addition to academic data, CORE schools will collect information about important aspects of non-classroom learning including social awareness, self-efficacy, and positive school culture to create a School Quality Improvement Index. This data will be used to measure an atmosphere that promote student and teacher sense of belonging, respect for diversity, and perceived fairness of disciplinary rules. Cross-district data collaboration will give educators and policymakers important insight to exactly what is happening in schools in a useful way.

After a field test involving over half-a-million students in Spring 2015, preliminary findings indicate that students at schools with higher social-emotional and culture-climate performance scored better in terms of individual academic performance.

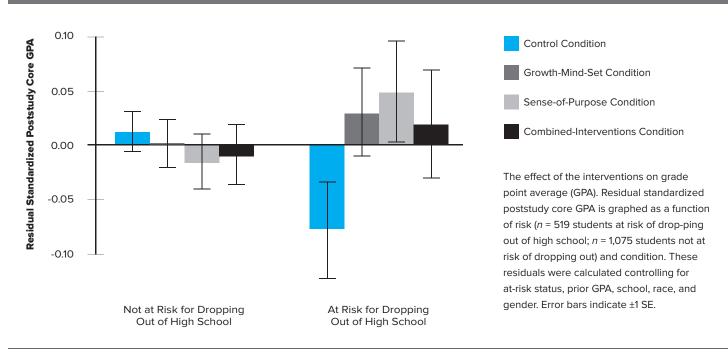
Source: Jorge Ruiz de Velasco, *CORE Districts and Deeper Learning*, John W. Gardner Center for Youth and Their Communities, Stanford University (Dec. 2015), https://gardnercenter.stanford.edu/sites/default/files/CORE%20Districts%20and%20Deeper%20Learning%20Report\_1.pdf.

#### 11. Changing Hearts While Educating Minds

#### (Nationwide High Schools)

Educators can now combine data sets from across several schools to test theories across a broad variety of students. While previous experiments have demonstrated the importance of student mindset on academic achievement, many studies exploring "mindset interventions" examined only small sets of students due to practical limitations and the need for a consistent experimental control. In Spring 2012, however, by using computerized interventions in 13 geographically diverse high schools researchers established that mindsetbased intervention approaches consistently raised grades. The effect was particularly strong with students at highest risk of dropping out, increasing the number who satisfactorily completed core courses by 6.4 percent.

#### Percentage of Students Graduating High School



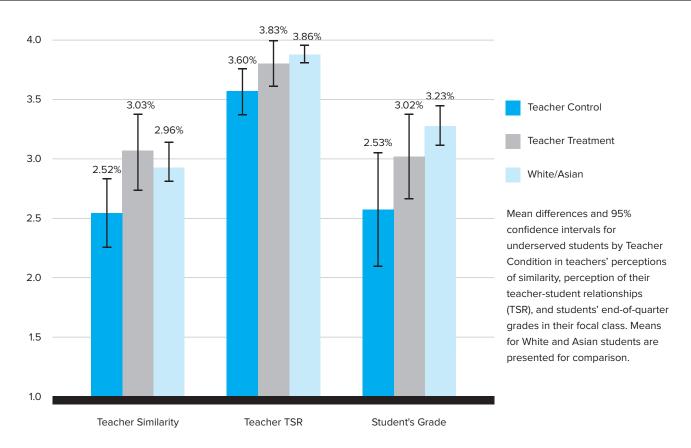
Source: David Paunesku et al., Mind-set Interventions Are a Scalable Treatment for Academic Underachievement, 26 PSYCHOLOGICAL SCIENCE 784 (2015), http://pss.sagepub.com/content/26/6/784.

#### 12. My Teacher, Myself

#### (Ninth Grade Public Schools)

Educators can also use data in less obvious ways to forge better connections between students and teachers. Researchers from the Harvard Graduate School of Education conducted a study based on the hypothesis that students who perceive similarities with their teachers would show improved real world relationships and academic performance. After taking surveys about school interests and hobbies, some ninth grade students received a list of five commonalities they shared with their teachers, and some instructors received similar information about some students. At the end of the semester, students whose teachers had received similarity profiles earned higher grades, with traditionally underserved black and Latino students benefitting most from the similarity interventions. Researchers calculated this brief intervention helped close the achievement gap by 60 percent.

#### **Similarity Interventions**



Notes: The 65% reduction in the achievement gap shown in the right-hand triad of bars corresponds to the difference between less than a B- to a B.

Source: Hunter Gehlbach et al., Creating Birds of Similar Feathers: Leveraging Similarity to Improve Teacher-Student Relationships and Academic Achievement, JOURNAL OF EDUCATIONAL PSYCHOLOGY (forthcoming), https://dash.harvard.edu/handle/1/23575714.

#### 13. College: Knowing Where To Go and How To Get There

(New York City Public High Schools)

More detailed information allows educators to look beyond basic trends to see specific school services that require more attention. The Research Alliance for New York City Schools created a unique data set depicting students' academic trajectories by combining high school level data from the New York City Department of Education with post-secondary information from the National Student Clearinghouse. The study not only indicated that high school graduation rates and college enrollment had increased, but also allowed researchers to look more deeply into results for who went on to college. The analysis revealed that 20 percent of well-qualified students did not enroll in any post-secondary institution. As a result, educators and reformers increased focus on the non-academic barriers to college enrollment like knowledge of options and navigating the admissions process. The Research Alliance has implemented the iMentor College Ready Program specifically designed to support non-academic college preparation beginning in ninth grade.

#### Examples of Key "Non-Academic" Student Outcomes

Outcome	Sample Items
Academic Self-Confidence	"I am confident in my academic abilities." "I do well in school."
Critical Thinking	"I can easily express my thoughts on a problem." "I usually have more than one source of information before making a decision"
Grit	"I am a hard worker." "I finish whatever I begin."
Meaniful School Participation	"In my school, I help decide things like class activities or rules." "In my school, I do things that make a difference."
Educational Aspirations	"The level of education I want to get" "The level of education I think I will need"
Adult Support for College and Career Planning	"How many non-relative adults could you ask about what it's like to be in college?" "How many non-relative adults could you ask about a career you are interested in?"

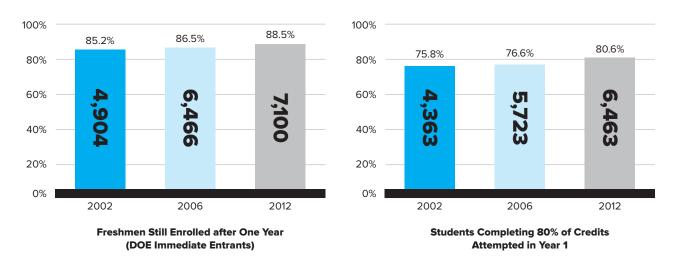
Sources: Lisa Merrill et al., *Bringing Together Mentoring, Technology, and Whole-School Reform, Schools*, The Research Alliance for New York City Schools (2015), <a href="http://steinhardt.nyu.edu/scmsAdmin/media/users/sg158/PDFs/iMentor\_BringingTogetherMentoringTechnologyAndWholeSchoolReform/BringingTogetherMentoringTechnologyAndWholeSchoolReform.pdf">http://steinhardt.nyu.edu/scmsAdmin/media/users/sg158/PDFs/iMentor\_BringingTogetherMentoringTechnolOgyAndWholeSchoolReform/BringingTogetherMentoringTechnologyAndWholeSchoolReform.pdf</a>; Chelsea Farley, *Better Evidence for Better Schools*, The Research Alliance for New York City Schools (2014), <a href="http://steinhardt.nyu.edu/research\_alliance/publications/better\_evidence\_brief">http://steinhardt.nyu.edu/research\_alliance/publications/better\_evidence\_brief</a>.

#### 14. Fading Before the Finish Line

#### (New York City Public High Schools)

Synthesizing data across institutions and over time helps identify causal relationships. Only a third of New York City high school students graduate from college within four years – but how do we understand why? As part of the Graduate! (GNYC) initiative, the New York City Department of Education and the City University of New York (CUNY) created a partnership to match student records across a shared data set. The ability to track individual student pathways revealed that almost four of five public high school graduates needed remediation when they got to city community colleges, suggesting a mismatch between what was on the state high school tests, and what students actually needed to know in college. As a result, GNYC has begun projects to better match curricula and bridge the transition between New York City public high schools and CUNY colleges, with promising initial results.

#### **Bridging the Transition**



Baccalaureate persistence rates have improved and more students have reached credit accumulation benchmarks

Source: Partnering for Educational Success in NYC: NYC DOE & CUNY, Philanthropy New York, (Summer 2014) <u>https://philanthropynewyork.org/sites/de-fault/files/Partnering%20for%20Educational%20Success%20in%20NYC.pdf</u>.

#### **III. POSTSECONDARY EDUCATION**

#### 15. On a Long Journey, Every Step Matters

#### (Georgia State University)

Georgia State University serves a large student body with predominantly minority students. To address retention issues, the school analyzed 2.5 million grades of former students to learn what may trip up current ones and used this information to create an early warning system to catch at-risk students before they fail. For example, Georgia State found that student who score a C or lower on the first course in their major only go on to graduate 25 percent of the time. As a result, the school implemented a program for students who get a C in their first course. Students are invited to meet with an advisor and given the opportunity to discuss and consider their options, such as switching their major. Additionally, in 2014, the data showed that 2,000 upperclassmen signed up for classes that did not satisfy the requirements for their majors. This analysis prompted school advisors to meet with students one-on-one and create a more appropriate course list. Since these changes, GSU's six-year graduation rate have increased from 32 percent in 2003 to 54 percent in 2014, and they conferred 30% more degrees in 2013 than five years earlier. The results have been so successful that President Obama praised GSU for promoting educational success and equality during the 2014 White House College Opportunity Summit.

#### **Georgia State Degree Conferrals**

07-08	08-09	09-10	10-11	11-12	12-13	5-Yr Change	
5,857	6,188	6,419	6,901	7,365	7,590	+30%	

Source: Martin Kurzweil and D. Derek Wu, *Building a Pathway to Student Success at Georgia State University*, Ithaka S+R (2015), http://www.sr.ithaka.org/ wp-content/uploads/2015/08/SR\_Case\_Study\_Building\_Pathway\_Student\_Success\_042315\_0.pdf. *Improving student outcomes with data-driven advising and intervention: A case study from Georgia State University*. 2014; 2015 Martin Kurzweil D. Derek Wu, *Building a Pathway to Student Success at Georgia State University* April 23, 2015, at http://www.sr.ithaka.org/wp-content/uploads/2015/08/SR\_Case\_Study\_Building\_Pathway\_Student\_Success\_042315\_0. pdf; Timothy M. Renick, Guiding at-Risk Students to Success at Georgia State University, GPS Policy Institute (June 25, 2014), <u>http://completecollege.org/</u> wp-content/uploads/2014/07/TRenick-Breakout-Session-PowerPoint.pdf.

#### 16. Transfer Students Are Part of the Family Too

#### (University of Maryland University College)

Data shared between schools is critical for those transferring from a community college to a four-year university. Researchers analyzed information from the University of Maryland University College (UMUC), Montgomery College (MC), and Prince George's Community College (PGCC) to identify factors associated with transfer student success. They combined several previously siloed data sets, including information extracted from the schools' student information systems, customer-relationship management (CRM) systems, advising systems, and online classroom learning management systems. This consolidated data set revealed that two accounting courses in particular in the UMUC Business School had low completion rates in comparison to other courses. Guided by the findings, UMUC created an online tutoring intervention for accounting students that improved pass rates and significantly increased end-of-semester grades overall.

#### Please Enter Each Student Response

UMUC Success Calculator		Predicting Graduat
Student Information		Math at CC
Gender	Male	Percentage of Courses
Age at Transfer	25	Received as Associate
Race/Ethnicity	Asian	CC Cum GPA
PELL Grant Recipient	No	CC Cum Credits Earne

Predicting Graduation		
Math at CC		No
Percentage of Courses Withd	20%	
Received as Associated Degre	Yes	
CC Cum GPA	3.56	
CC Cum Credits Earned		60
First Term GPA at UMUC	3.5	
UMUC First Term Credits Earned		12
Probability of Graduating in Eight-Year Period	Calculate	77%

#### Accounting 220 and Accounting 221

In collaboration with the Predictive Analytics Reporting Framework (PAR, www.parframework. org), a Gates Foundation funded project, the PASS Project team identi ed Accounting 220 and 221 as a course sequence with low course completion rates compared with other UMUC courses. e UMUC faculty teaching Accounting 220 and Accounting 221 developed and implemented an online tutoring intervention for UMUC accounting students. e PASS Project team evaluated the e ectiveness of the online tutoring intervention. Students participating in online tutoring had a signi cantly higher term GPA and a signi cantly higher rate of successful course completion, when compared to students not participating in online tutoring.

	<b>Test</b> Participating in Online Tutoring	Control Not Participating in Online Tutoring
Term GPA	2.52	2.10
Successful Course Completion	72%	58%
Re-Enrollment	78%	72%

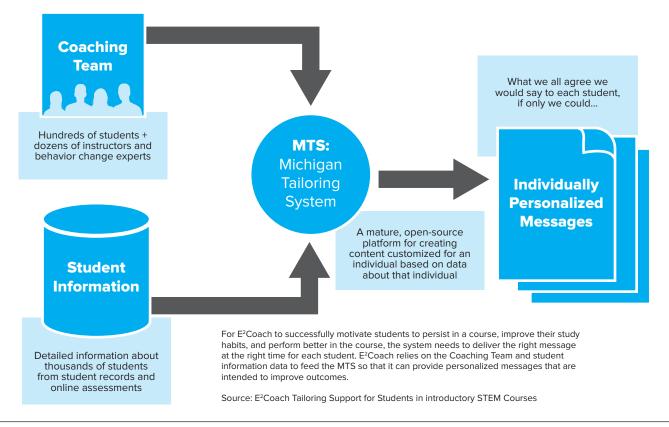
Source: Beth Dietz-Uhler and Janet E. Hurn, Using Learning Analytics to Predict (and Improve) Student Success, 12 JOURNAL OF INTERACTIVE ONLINE LEARNING 17 (2013), <u>https://www.umuc.edu/visitors/about/ipra/upload/predictive-analytics-for-student-success-executive-report.pdf</u>.

#### 17. From Mom, We'd Call It Nagging

#### (University of Michigan)

Data can be aggregated to show patterns, correlations, and trends – which can then be reversed to implement very personalized applications. The University of Michigan's Department of Physics analyzed longitudinal data sets reflecting the academic performance of nearly 49,000 introductory physics students over a period of fourteen years to discover what actions corresponded with student success. They used this information to create their E2Coach automated guidance system for new physics students.

E2Coach uses up-to-date information about students' interaction with online coursework and resources and weekly performance to create personalized emails containing advice on what content and activities they should prioritize, and suggesting alternative study methods, and additional support resources. Students can see their performance in relation to their peers. Instructors receive notifications when their pupils do particularly poorly or well, and advisors get performance and background information about struggling students. Students who used the program earned higher grades than comparable non-users and had a 99 percent completion rate. The more a student used E2Coach, the more likely she was to outperform her predicted course grade, with high users outperforming nonusers by a third of a letter grade. Researchers continue to use and refine the E2Coach system with increasing success.



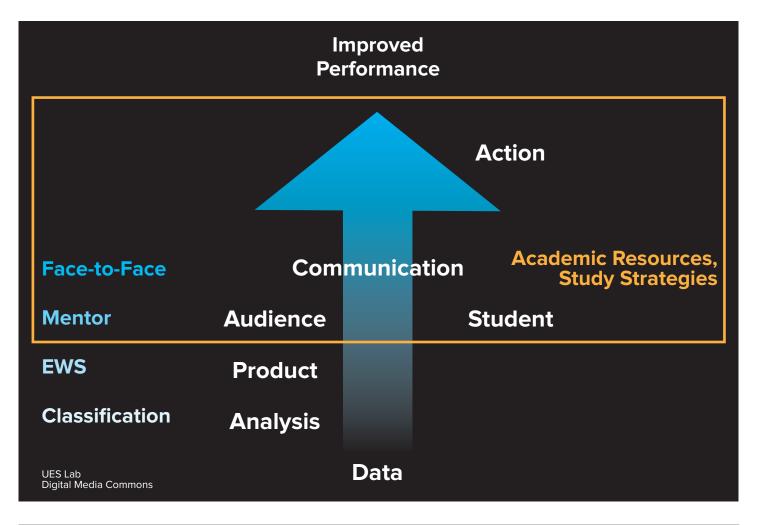
#### TAILORING MESSAGES FOR SPECIFIC STUDENTS

Source: Madeline Huberth et al., *Computer-Tailored Student Support in Introductory Physics*, 10 PLoS ONE 1 (2015), http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0137001;Tim McKay et al., *What to Do with Actionable Intelligence: E2Coach As an Intervention Engine*, Proceedings of the 2nd International Conference on Learning Analytics and Knowledge (2012), <u>https://www.researchgate.net/publication/254462713\_What\_to\_do\_with\_action-able\_intelligence\_E2Coach\_as\_an\_intervention\_engine</u>.

#### 18. I Get By With a Little Help From My Friends...and Mentors

#### (M-Stem Academy, University of Michigan)

Data can also help advisors at the university level catch students before they fall too far behind. Researchers developed an early warning system (EWS) for a mentoring program, M-STEM Academy, which supports minority and underrepresented undergraduate engineering students. This program provided mentors with more detailed realtime information, while allowing them to make their own decisions regarding appropriate interventions. The prediction program used information from the campus Learning Management Systems and homework assignments to create weekly classifications reflecting students' current academic performance and their degree of interaction with the program site. The program then sent reports to the M-STEM student mentors recommending whether they should simply encourage students to keep doing well, explore students' progress in more detail, or immediately engage students to assess possible academic difficulties. The program helped mentors focus on struggling students they had overlooked, in particular third and fourth year students who had fallen behind, and prompted the mentor to reach out.

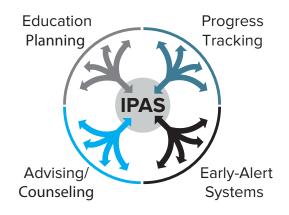


Source: Steven Lonn et al., *Bridging the Gap from Knowledge to Action*, Proceedings of the 2nd International Conference on Learning Analytics and Knowledge (2012), <u>https://ctools.umich.edu/access/content/group/research/papers/LAK\_Analytics\_Acad\_Advisors.pdf/</u>.

#### 19. The Best Laid Plans...Lead to Graduation

#### (Colorado State University)

Colorado State University used academic analytics to examine patterns of student success and improve retention. In doing so, it found that the graduation rates of students who failed to take math or composition in their first year were significantly lower than those of students who did. As a result, CSU changed the requirements for first-year students, to include those courses. Data analysis using integrated planning and advising services (IPAS) technologies also revealed that students who dropped courses mid-semester took longer to graduate, received grades that put their financial aid packages at risk, and suffered lower confidence levels. To address these issues, the school created a series of credit-recovery courses starting halfway through each semester to aid students in keeping their full-time status and financial aid packages, and maintaining momentum towards graduation.



Source: D. Christopher Brooks, *IPAS Evaluation and Assessment Guide*, Educause Center for Analysis and Research (May 2015), https://net.educause.edu/ir/library/pdf/ERS1506.pdf.

#### CONCLUSION

Thoughtful use of education data allows students to take control of their destiny, and ensures accountability. Our education system needs to adapt to diverse, non-traditional student bodies and to meet the demands of an increasingly knowledge-based economy. New technologies generate a higher quality and quantity of data – which can be aggregated across years, schools, and sources so that sophisticated analytical tools yield insights that researchers, educators, and policymakers can use for student and institutional success.

These understandings and outcomes have the potential to make the learning process more effective by transforming teaching theory and practice. They prompt curricula and counseling reforms to address discipline, achievement, and retention gaps and provide more consistent means of evaluating student performance and making eligibility determinations. They reveal ways that bias may unexpectedly influence the outcomes of facially objective programs and policies. Finally, access to real-time information about student progress empowers students and educators to make timely adjustments to their studying and instructional practices. Properly used, mindfully implemented, and with appropriate privacy protections, student data is a tremendous resource to help schools fulfill the great promise of providing quality education for all.



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#### 19 TIMES DATA ANALYSIS EMPOWERED STUDENTS AND SCHOOLS: WHICH STUDENTS SUCCEED, AND WHY?

BY ELANA ZEIDE MARCH 2016