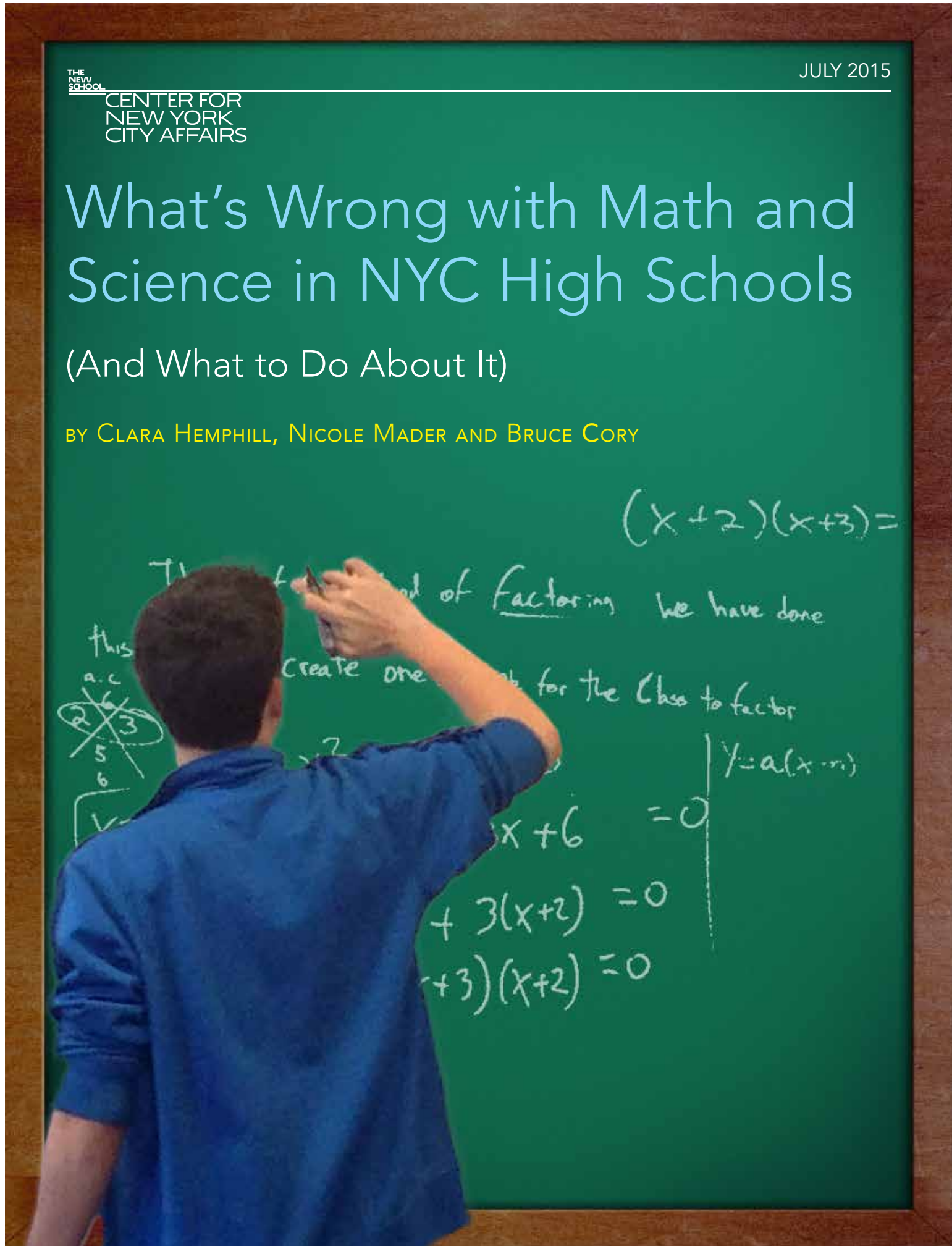


What's Wrong with Math and Science in NYC High Schools

(And What to Do About It)

BY CLARA HEMPHILL, NICOLE MADER AND BRUCE CORY



Founded in 2004, the Marie Curie School for Medicine, Nursing and Health Professions is a small Bronx high school that attracts students eager to become registered nurses. The atmosphere of the school encourages those dreams; students wear scrubs to class and teachers wear lab coats.

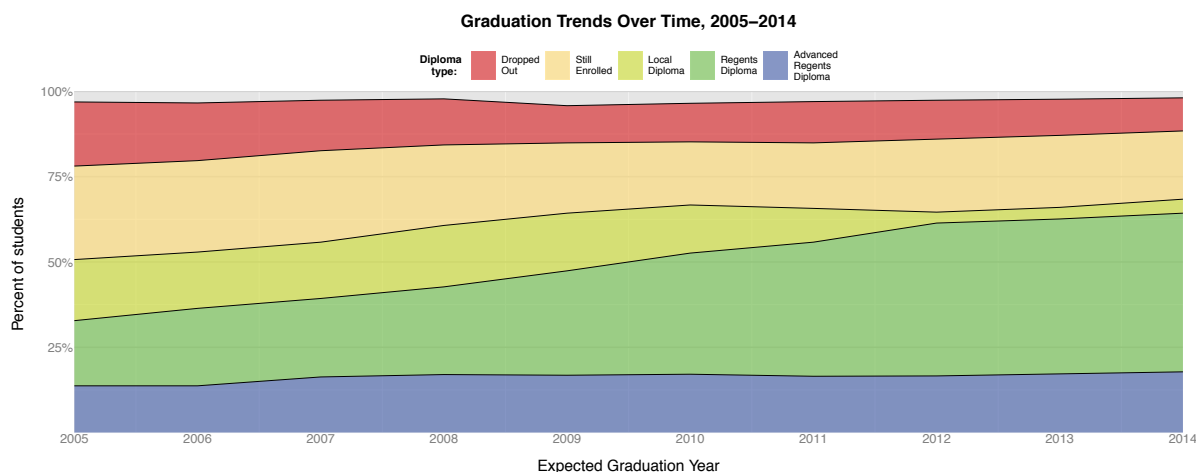
And at one level, the school is a success; more than two-thirds of its students graduate within four years, making Marie Curie a sturdy exemplar of the small school movement that has fueled a sharp increase in New York City's high school graduation rate since 2002.

But here's the rub: Only a small proportion of Marie Curie graduates go on to four-year college programs in nursing. Marie Curie's graduates are more likely to become certified nursing assistants—a job which doesn't require a college education—than registered nurses, according to teachers at the school. The median pay for certified nurse assistants is about \$24,000 a year. For registered nurses,

the median pay is about \$65,000, according to the Bureau of Labor Statistics.

The sad irony is that at a school named for the only person ever to receive Nobel Prizes in both physics and chemistry, few students pass Regents exams in either of those subjects, and as a result, few are prepared for careers in science. Just 4 percent of Marie Curie students graduated in 2014 with an Advanced Regents diploma—awarded to students who pass three college-prep math exams and two college-prep science exams (along with two history exams and one English exam). And just 20 percent of the school's 2014 graduates had test scores on basic algebra and English exams that were high enough to avoid remediation at CUNY. That means most Marie Curie graduates must pay to take remedial classes if they go to college—classes they should have received for free in high school.

The Common Core State Standards are supposed to ensure that every student graduates from high school prepared for college or a career. But an analysis of high school math and science performance by the Center for New York City Affairs shows just how far the city is



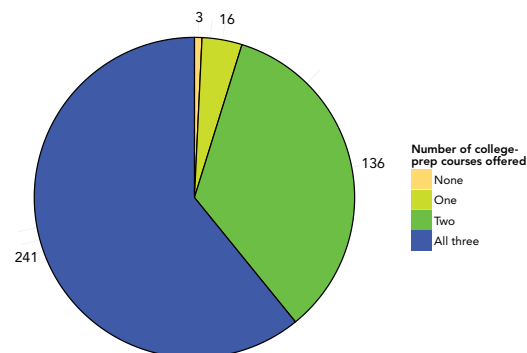
from reaching that goal. While the graduation rate has steadily increased over the past decade, the proportion of students receiving an Advanced Regents diploma—one commonly used measure of college readiness—has stagnated. In 2014, just 18 percent of students starting New York City high schools four years earlier earned Advanced Regents diplomas.

As new, more difficult exams aligned to the Common Core are phased in, Advanced Regents diplomas may be even further out of reach.¹

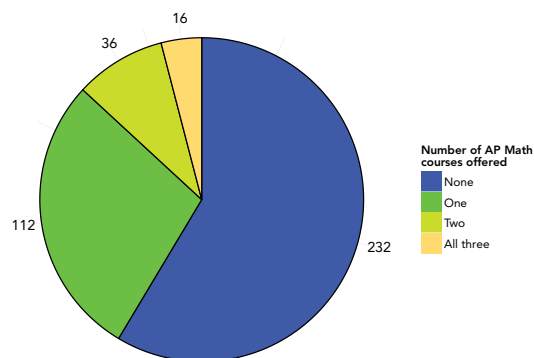
Another finding of the Center's analysis shows just how daunting that challenge could be. To-day, 39 percent of the city's high schools do not offer a standard college-prep curriculum in math and science, that is, algebra 2, physics and chemistry. More than half the schools do not offer a single Advanced Placement course in math and about half do not offer a single Advanced Placement course in science.² [For a complete list of schools click here.](#)

Roughly 21 percent of New York City high school students attend schools that don't offer courses in both chemistry and physics. Many of these are the new small high schools that proliferated during the administration of Mayor Michael Bloomberg. And even at Marie Curie and other small schools where both chemistry and physics are taught, too many students lack the grounding in math needed to take or pass them.

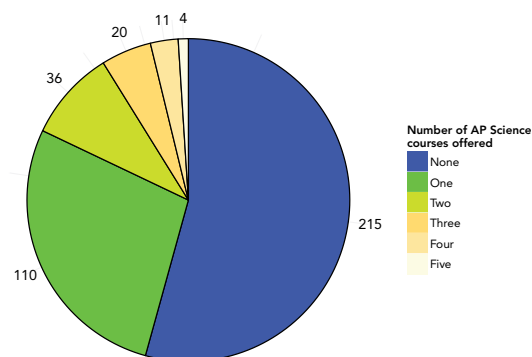
Number of High Schools Offering a College Prep Curriculum (Algebra 2, Chemistry and Physics) in the 2013–14 School Year



Number of High Schools Offering an AP Math Curriculum (Calculus AB or BC, Statistics and Computer Science) in the 2013–14 School Year



Number of High Schools Offering an AP Science Curriculum (Biology, Chemistry, Physics, Environmental Science and Psychology) in the 2013–14 School Year



1. The Advanced Regents diploma is only one measure of college readiness. Notably, the NYC public high schools in the New York Performance Standards Consortium, which are exempt from Regents exams, use portfolios and performance-based assessments to measure student achievement and some boast high graduation rates as well as college readiness, attendance and retention.

2. Advanced Placement classes are only one indicator of academic rigor. Schools that follow an early college model—such as Bard High School Early College and Queens School of Inquiry, as well as schools that have robust College Now programs—may not offer official AP courses but do provide high-level courses for college credit.

(Three years of science is a graduation requirement in all city high schools. Students at schools that don't offer the full complement of college-prep sciences meet that requirement by taking one of these sciences, usually biology—or as it's known in New York schools, "living environment"—and supplementing that with courses such as forensics or general science.)

The result is an intense bifurcation of the city's public high school system—one that parents frantic to get their children into top high schools are acutely attuned to. Looking at statistics from August 2014, the Center for New York City Affairs found that 48 percent of the New York City public high school students receiving Advanced Regents diplomas are clustered in just 25 schools. At 100 other schools, on the other hand, not a single student received an Advanced Regents diploma.

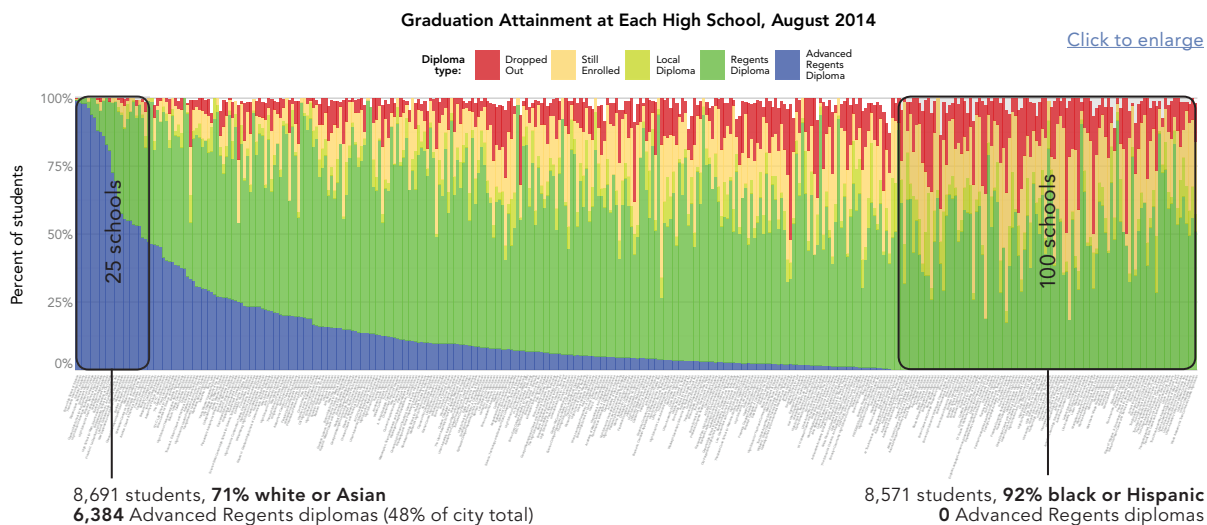
Like so much else in the city's public schools, this dramatic split reflects an equally sharp racial divide. While white and Asian students make up less than one-quarter of citywide public high school enrollment, they constitute roughly 70 percent of the students at the top

city high schools awarding Advanced Regents degrees. At the 100 schools where no Advanced Regents diplomas were awarded, the student body was 92 percent black and Hispanic. Many of these schools are among the hundreds of small secondary schools the city has opened in recent years.

How have the city's public high schools painted themselves into such an unenviable corner? Part of the explanation is the inadequate foundation laid in elementary and middle school for taking college-prep science and math courses in high school—a shortfall that the Common Core curriculum is specifically designed to overcome. And grappling with that shortfall has been a key factor in both the undeniable successes and the unintended shortcomings of the Bloomberg administration's school reform program.

Ending dysfunction, entrenching division: What high school reform hath wrought

That Bloomberg and his first schools chancellor Joel Klein inherited a deeply dysfunctional system of public high schools is beyond de-



bate. When they assumed office in 2002, by the city's calculations only about 51 percent of high school students graduated within four years—a graduation rate that had remained more or less constant for at least a decade.³ There were, to be sure, shining exceptions of excellent city high schools, and there was also a nascent “under-the-radar” movement of small progressive schools designed to help students at risk of failure. But many other high schools were mired in cultures of long-term mediocrity.

In response, Bloomberg and Klein undertook a wholesale overhaul of the city's high schools. It was a reform effort built on the assumption that broader student choice and healthy competition among schools would weed out floundering schools, reward successful ones and improve the system overall.

During the Bloomberg years, large traditional neighborhood schools, which in some cases had enrollments of more than 3,000 students and which were widely seen as poster children of failure, were closed. Many were replaced with six to eight smaller schools of roughly 400 students occupying the old school campuses, often one to each floor. By the end of the Bloomberg years, the city, with support from the Carnegie Corporation, Open Society Institute, Bill and Melinda Gates Foundation and other philanthropies, had opened more than 650 new small schools, most of them high schools. At the same time, school choice, once an option for New York City students entering

high school, became mandatory; all 8th-graders were required to fill out applications listing their preferences for high school.

The positive results were impressive. In December 2013, during his final weeks at City Hall, Bloomberg released numbers showing that since 2005 the four-year graduation rate had climbed to 66 percent—an all-time high. (The base year used for comparison was 2005, not 2002, because in 2005 the State Department of Education changed the way that on-time graduation rates are calculated. City officials also used August rather than June graduation numbers to define on-time graduation.) The graduation rate of the city's black public high school students had jumped 52 percent during those years; Hispanic students posted a 58 percent gain.⁴

Bloomberg and then-chancellor Dennis Walcott presented evidence that the city's new small high schools were a key factor in this impressive progress—and most outside experts agreed that the new schools had significantly outperformed the neighborhood schools they had replaced. Reporting by MDRC, the respected education and social policy research organization, began in 2010 and found in August 2013, for example, that new small schools continued to “significantly raise graduation rates” in New York City, demonstrating that “large-scale transformation is possible in an urban public school system.”⁵ And the city's on-time high school graduation rate continued to inch up in 2014, to

3. “New York City Graduation Rates 2011 (2007 Cohort),” New York City Department of Education presentation, http://www.nyc.gov/html/om/pdf/2012/2011_grad_deck_presentation.pdf.

4. “Mayor Bloomberg and Chancellor Walcott Announce New York City Students Achieved All-Time Record High School Graduation Rates in 2012–2013 School Year,” City of New York press release, December 4, 2013, <http://www1.nyc.gov/office-of-the-mayor/news/387-13/mayor-bloomberg-chancellor-walcott-new-york-city-students-achieved-all-time-record#0>.

5. Howard S. Bloom, Saskia Levy Thompson and Rebecca Unterman, “Transforming the High School Experience: How New York City's New Small Schools Are Boosting Student Achievement and Graduation Rates,” MRDC, June 2010.

68.4 percent (using the city's methodology) or 4.2 percent (using the state's).

For many black and Hispanic students, smaller high schools have indeed been lifeboats rescuing them from the sinking *Titanics* of neighborhood high schools. With their smaller student bodies and 28-student class size limits (down from 34-student classes in their predecessor neighborhood schools), greater individual attention was virtually guaranteed for struggling students who might otherwise have become lost in larger schools. The small schools also tended to be safer and more student-friendly than the behemoths they replaced. The result: Literally tens of thousands of young people who attended these schools and who otherwise might well have dropped out now have high school diplomas.

Nevertheless, their lagging record in granting Advanced Regents diplomas shows that the new small schools also operate under severe constraints. Many of their students, for example, arrive in 9th grade two, three or even four years behind grade level. In these schools, remediation is the order of the day. In the arena of science and math, the schools' response has been to focus resources on helping kids meet the minimum required for earning a Regents diploma: passing one Regents exam for math (usually algebra), one for science (usually living environment), as well as Regents tests in English language arts, U.S. history and world history.

Some struggling high school students, of course, are late-bloomers. They hit their stride as freshmen, bring themselves up to grade level and then are ready for more advanced coursework in their upper-class years. But while small schools may help such students catch up, with notable exceptions they're also generally not helping them advance to higher-level coursework—or even offering such classes.

The irony of unintended consequences

So while the city's effort to replace large neighborhood schools with small high schools has had many benefits, it has also had at least two unforeseen downsides that deepen the divide between schools that make students college ready and those that don't.

Today, 39 percent of the city's high schools do not offer a standard college-prep curriculum in math and science, that is, algebra 2, chemistry and physics.

First, school choice, while designed to be liberating, has perversely instead tended to replace one trap with another. In the bad old days when neighborhood high schools were the norm, where students lived largely determined the quality of their education. Students were, as Chancellor Klein and others pointed out, unfairly imprisoned by their zip codes. Now, however, the city's new high school system instead makes most students captives of their 7th-grade transcripts and test scores, the measures used to admit them to high school. There are exceptions—the schools that require students to take an exam or audition for admission. But it's far more common for schools to use 7th-grade transcripts. Some require students to have a 90 average in 7th grade—some 85, some 80, some 75—and some are open to all regardless of their test scores. This creates a stratification of schools based on student performance in middle school. The result is that lagging students

are tracked into schools where even spectacular academic improvement in the 9th or 10th grades is nevertheless unlikely to lead to their earning Advanced Regents diplomas.

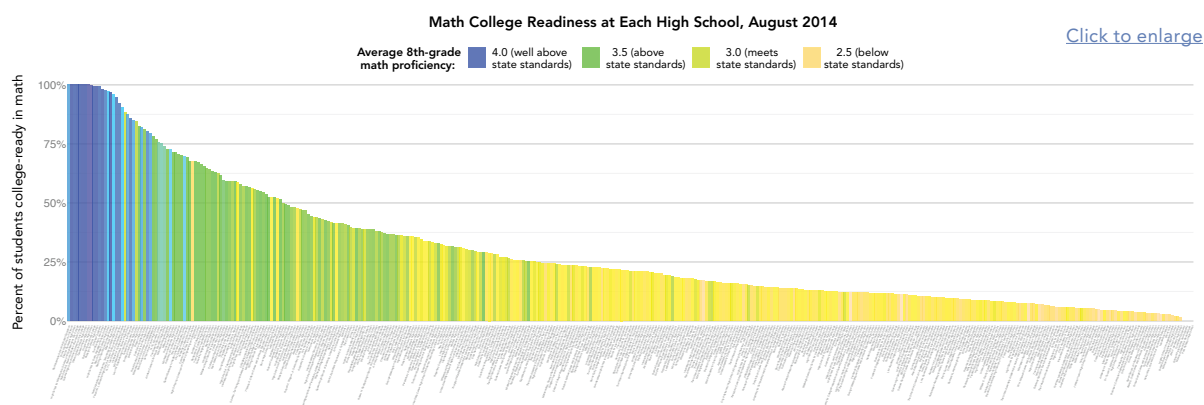
The second irony of this new stratification is that it is, in one respect, even more rigid than the status quo ante that it replaced. Consider the now virtually extinct large neighborhood high schools of New York City. Perhaps only 1 percent of the 3,000-plus students at one of them might have been prepared for advanced math, chemistry or physics. Those 30 or so students, however, represented a critical mass large enough to warrant offering such courses. So a late-blooming learner might well have been able to land a seat in such a classroom. In a high school of 400 kids, however, the comparable critical mass for creating advanced classes has to be much larger than just 1 percent of the students before it makes sense to commit the necessary time and effort. Sometimes, that critical mass simply doesn't exist.

The Department of Education policy limiting transfers exacerbates the problem. Students

may not transfer from one school to another unless they can prove their health and safety is in danger—usually with a police report documenting an assault. This means a late bloomer may not, for example, transfer from a small school with a limited curriculum to a larger school with a broad curriculum except in extraordinary circumstances.

The achievements of the small high schools created in the city over the past 10 years are incontestable. They have, as New York University researcher Leslie Siskin has written, done an enormously useful job of “bringing the bottom up.”⁶ But now the limitations and contradictions of this reform effort have become increasingly evident too. As the new Common Core Standards require ever-higher levels of achievement, high schools cannot bear the burden alone of preparing students for college.

Indeed, an analysis by the Center for New York City Affairs shows that for many students, the die is cast before they arrive in 9th grade. At high schools in which most students arrive well-prepared, most graduate with skills that



6. Leslie Santee Siskin, “Changing Contexts and the Challenge of High School Reform in New York City,” in *Education Reform in New York City*, ed. Jennifer A. O’Day, Catherine S. Bitter and Louis M. Gomez (Cambridge: Harvard University Press, 2011), 193.

CUNY considers “college ready”—that is, scoring at least 480 on math SATs or at least 80 on the Algebra 1 Regents. But the reverse is also true: It’s very difficult for students to overcome poor preparation in elementary and middle schools. Most students who enter 9th grade with weak math skills don’t catch up: If they go to college, they must take remedial classes.

Recommendations: Building on what already works

On the positive side, some schools have developed strategies to beat the odds. The staff of Insideschools, a project of the Center for New York City Affairs, visited 180 elementary, middle and high schools from 2013 to 2015 and discovered many that were successful in meeting the Common Core State Standards for math while offering challenging courses for science. (New York State has not yet adopted the Common Core for science). The Department of Education should use these schools as models and encourage others to emulate their success.

Help teachers overcome their own math phobia. Many elementary school teachers are anxious about their own ability in math—and pass on their anxiety to their pupils, particularly to girls. A number of elementary schools, including PS 63-STAR Academy on the Lower East Side, have helped teachers conquer their fears by giving them time to re-learn math, framed in a different way so they understand the underlying concepts ([See: Overcoming Teachers’ Math Anxiety](#)).

Hire math specialists in 5th grade. The original KIPP Academy Charter School in the Bronx serves children in grades 5–8. Because this middle school begins in 5th grade, children get the benefit of having specialized teachers

earlier than in most middle schools that begin in 6th grade. Fifth-graders get two hours of math instruction from a certified math teacher every day; by the end of 8th grade, nearly all are well-prepared for high school and many take the algebra Regents exam that year.



Fewer than half of the city’s high schools offer Advanced Placement science classes.

Invest in schools that serve grades 6–12. The continuity of instruction at the Urban Assembly School for Applied Math and Science in the Bronx helps students succeed through seven years of middle school and high school. Though many students start off with weak skills in 6th grade, by the end of 8th grade roughly half pass the Algebra Regents exam, setting them up to take calculus before they graduate from high school. The school sends some graduates to highly selective colleges like Cornell and Brown—a particularly impressive accomplishment given that the school doesn’t screen students for ability and most come from one of the poorest neighborhoods in the country.

Offer “conceptual” chemistry and physics for high school students with weaker math skills. Many students miss out on chemistry and physics in high school because they don’t have the math skills necessary to be successful in courses that lead to Regents exams. Some schools have developed courses, stripped of higher-level math, that at least give students an introduction to these subjects. At Quest to Learn in Manhattan, for example, 10th-graders may take a conceptual chemistry class. If they are successful and their math skills develop over the year, they may take Regents-level chemistry the following year. If not, at least they have had some exposure to chemistry.



A “conceptual” chemistry class offers students with weak math skills an introduction to the subject.

Devote more time to math in middle and high school. One big problem the Insideschools staff discovered is that the traditional structure of the school day allows for just 42

minutes a day of math instruction—less time than most elementary schools offer. Many of the successful schools allowed significantly more time for teaching math. For example, at Park East High School in East Harlem, 9th-graders take two math classes, one in algebra and one called “math applications.”

Encourage small schools to share teachers and resources. Small schools have many benefits, but they often don’t have the resources to offer higher-level math and science classes because just a few students would take them. The Tortora-Sillcox Family Foundation is working with NMSI (National Math and Science Institute) on a program to create a number of high-level STEM courses on the Erasmus Hall Educational Campus in Brooklyn. All of the building’s five schools will participate when the program is launched in fall 2015, with teachers from the various schools teaching courses open to all.

Putting Common Core to the test

The ultimate goal of the Common Core Standards is to “ensure that all students are ready for success after high school.”⁷ Today, judging by the number of Advanced Regents diplomas awarded in New York City public high schools, about 80 percent of students fail to clear that bar, as measured by their preparation for college or for well-paying careers. Many occupations are closed to students who don’t take physics, chemistry and advanced mathematics in high school. Dental hygienists need chemistry and people who install air conditioning systems need physics, according to the Bureau of Labor Statistics. The woeful lack of advanced math and science instruction

7. “What Parents Should Know,” Common Core State Standards Initiative, www.corestandards.org/what-parents-should-know/.

in our city's high schools is a loud and clear warning that if the high expectations embodied in the Common Core are going to be met in New York City, the limitations as well as the strengths of the city's current array of high schools have to be acknowledged. The good news is that research by the Center for New York City Affairs has identified hopeful existing models for ameliorating those shortcomings. Such efforts must now be encouraged and, where possible, replicated. Otherwise, students with high hopes enrolling in Marie Curie and similar schools will only continue to be disappointed—and the disturbing racial divide in high school instruction and outcomes in our city will only deepen.

What Courses Do Students Need?

Many occupations are closed to students who don't take physics, chemistry and advanced math in high school. Listed here are required courses for various occupations.

Accountant: pre-calculus
Architect: pre-calculus, physics
Dental hygienist: biology and chemistry
Electrician: algebra 1
Emergency medical technician: biology, chemistry
HVAC mechanic: physics
Lab technician: chemistry and biology
MRI technician: biology, chemistry, physics
Registered nurse: biology, chemistry

Source: Bureau of Labor Statistics

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