The New York Times | http://nyti.ms/1rctllb

So Bill Gates Has This Idea for a History Class ...

By ANDREW ROSS SORKIN SEPT. 5, 2014

In 2008, shortly after Bill Gates stepped down from his executive role at Microsoft, he often awoke in his 66,000-square-foot home on the eastern bank of Lake Washington and walked downstairs to his private gym in a baggy T-shirt, shorts, sneakers and black socks yanked up to the midcalf. Then, during an hour on the treadmill, Gates, a self-described nerd, would pass the time by watching DVDs from the Teaching Company's "Great Courses" series. On some mornings, he would learn about geology or meteorology; on others, it would be oceanography or U.S. history.

As Gates was working his way through the series, he stumbled upon a set of DVDs titled "Big History" — an unusual college course taught by a jovial, gesticulating professor from Australia named David Christian. Unlike the previous DVDs, "Big History" did not confine itself to any particular topic, or even to a single academic discipline. Instead, it put forward a synthesis of history, biology, chemistry, astronomy and other disparate fields, which Christian wove together into nothing less than a unifying narrative of life on earth. Standing inside a small "Mr. Rogers"-style set, flanked by an imitation ivy-covered brick wall, Christian explained to the camera that he was influenced by the Annales School, a group of early-20th-century French historians who insisted that history be explored on multiple scales of time and space. Christian had subsequently divided the history of the world into eight separate "thresholds," beginning with the Big Bang, 13 billion years ago (Threshold 1), moving through to the origin of Homo sapiens (Threshold 6), the appearance of agriculture (Threshold 7) and,

finally, the forces that gave birth to our modern world (Threshold 8).

Christian's aim was not to offer discrete accounts of each period so much as to integrate them all into vertiginous conceptual narratives, sweeping through billions of years in the span of a single semester. A lecture on the Big Bang, for instance, offered a complete history of cosmology, starting with the ancient God-centered view of the universe and proceeding through Ptolemy's Earth-based model, through the heliocentric versions advanced by thinkers from Copernicus to Galileo and eventually arriving at Hubble's idea of an expanding universe. In the worldview of "Big History," a discussion about the formation of stars cannot help including Einstein and the hydrogen bomb; a lesson on the rise of life will find its way to Jane Goodall and Dian Fossey. "I hope by the end of this course, you will also have a much better sense of the underlying unity of modern knowledge," Christian said at the close of the first lecture. "There is a unified account."

As Gates sweated away on his treadmill, he found himself marveling at the class's ability to connect complex concepts. "I just loved it," he said. "It was very clarifying for me. I thought, God, everybody should watch this thing!" At the time, the Bill & Melinda Gates Foundation had donated hundreds of millions of dollars to educational initiatives, but many of these were high-level policy projects, like the Common Core Standards Initiative, which the foundation was instrumental in pushing through. And Gates, who had recently decided to become a full-time philanthropist, seemed to pine for a project that was a little more tangible. He was frustrated with the state of interactive coursework and classroom technology since before he dropped out of Harvard in the mid-1970s; he yearned to experiment with entirely new approaches. "I wanted to explore how you did digital things," he told me. "That was a big issue for me in terms of where education was going — taking my previous skills and applying them to education." Soon after getting off the treadmill, he asked an assistant to set a meeting with Christian.

A few days later, the professor, who was lecturing at San Diego State University, found himself in the lobby of a hotel, waiting to meet with the

billionaire. “I was scared,” Christian recalled. “Someone took me along the corridor, knocks on a door, Bill opens it, invites me in. All I remember is that within five minutes, he had so put me at my ease. I thought, I’m a nerd, he’s a nerd and this is fun!” After a bit of small talk, Gates got down to business. He told Christian that he wanted to introduce “Big History” as a course in high schools all across America. He was prepared to fund the project personally, outside his foundation, and he wanted to be personally involved. “He actually gave me his email address and said, ‘Just think about it,’ ” Christian continued. " ‘Email me if you think this is a good idea.’ ”

Christian emailed to say that he thought it was a pretty good idea. The two men began tinkering, adapting Christian’s college course into a high-school curriculum, with modules flexible enough to teach to freshmen and seniors alike. Gates, who insisted that the course include a strong digital component, hired a team of engineers and designers to develop a website that would serve as an electronic textbook, brimming with interactive graphics and videos. Gates was particularly insistent on the idea of digital timelines, which may have been vestige of an earlier passion project, Microsoft Encarta, the electronic encyclopedia that was eventually overtaken by the growth of Wikipedia. Now he wanted to offer a multifaceted historical account of any given subject through a friendly user interface. The site, which is open to the public, would also feature a password-protected forum for teachers to trade notes and update and, in some cases, rewrite lesson plans based on their experiences in the classroom.

Gates, who had already learned about the limitations of large bureaucracies through his foundation, insisted that the course be pitched to individual schools, rather than to entire districts; that way, he reasoned, it could grow organically and improve as it did so, just like a start-up company. In 2011, the Big History Project debuted in five high schools, but in the three years since, Gates and Christian — along with a team of educational consultants, executives and teachers, mostly based in Seattle — have quietly accelerated its growth. This fall, the project will be offered free to more than 15,000 students in some 1,200 schools, from the Brooklyn

School for Collaborative Studies in New York to Greenhills School in Ann Arbor, Mich., to Gates's alma mater, Lakeside Upper School in Seattle. And if all goes well, the Big History Project will be introduced in hundreds of more classrooms by next year and hundreds, if not thousands, more the year after that, scaling along toward the vision Gates first experienced on that treadmill. Last month, the University of California system announced that a version of the Big History Project course could be counted in place of a more traditional World History class, paving the way for the state's 1,300 high schools to offer it.

"We didn't know when the last time was that somebody introduced a new course into high school," Gates told me. "How does one go about it? What did the guy who liked biology — who did he call and say, 'Hey, we should have biology in high school?' It was pretty uncharted territory. But it was pretty cool."

The American high school experience, at least as we now know it, is a relatively recent invention. Attendance did not start to become mandatory until the 1850s, and the notion of a nationwide standardized curriculum didn't emerge until the turn of the century. But by the early 1900s, most children were taking the same list of classes that remains recognizable to this day: English, math, science and some form of history. For much of the 20th century, this last requirement would usually take the form of Western Civilization, a survey course that focused on European countries from around the rise of Rome through modernity.

But by the early '70s, as the Vietnam War heightened interest in nations outside Europe, Western Civ was on the decline. In pedagogical circles, a book called "The Rise of the West: A History of the Human Community," by William Hardy McNeill, a historian at the University of Chicago, persuasively argued that Western Civ was not merely biased against other cultures but also failed to account for the enormous influence that cultures had on one another over the millenniums. In 1976, McNeill told a roomful of teachers at an American Historical Association meeting, "I find the apathy truly amazing; suicidal; absurd."

In the wake of McNeill's rebuke, Western Civ was slowly replaced by World History, a more comparative class that stressed broad themes across cultures and disciplines. Over the past 30 years, World History has produced its own formidable academic institutions and journals; these days, three-quarters of all American students take World History. The course was just beginning its ascent as David Christian, then a young professor at Macquarie University in Sydney, was incubating his own form of cross-disciplinary scholarship. Christian, who was teaching a course on Russian history, liked to examine his subjects from a number of unconventional angles. In the 19th century, "on average, 40 percent of Russia's revenues came from vodka sales, so what I realized is that if Russians stopped drinking vodka, you can't pay for the army, and the superpower collapses," he told me. "So I thought, Here's a modern government building its power by selling a mind-altering substance. I was looking at it at the fiscal level, at the treasury level — but also in the village and also in the tavern."

Christian began wondering if he could apply this everything-is-connected idea to a larger scale: "I began thinking, Could I teach a course not of Russia but of humanity?" He soon became infatuated with the concept. "I remember the chain of thought," he said. "I had to do prehistory, so I have to do some archaeology. But to do it seriously, I'm going to talk about how humans evolved, so, yikes, I'm in biology now. I thought: To do it seriously, I have to talk about how mammals evolved, how primates evolved. I have to go back to multicelled organisms, I have to go back to primeval slime. And then I thought: I have to talk about how life was created, how life appeared on earth! I have to talk geology, the history of the planet. And so you can see, this is pushing me back and back and back, until I realized there's a stopping point — which is the Big Bang." He paused. "I thought, Boy, would that be exciting to teach a course like this!"

His interest in transcending borders perhaps derived from his own peripatetic childhood. Born in Brooklyn to an American mother and a British father, Christian spent the first seven years of his life in Nigeria and then was shipped off to an English boarding school. (To this day, his accent

— a bewildering mix of Colonial English, Eton and Jackie Gleason — reflects this unusual provenance.) Sitting along a wooden table in a Midtown Manhattan hotel, Christian delighted in recounting the first year he taught his history-of-everything course, in 1989, at Macquarie. Perhaps unwisely, he had committed to teaching it to incoming freshmen, some 300 students. "We didn't know what we were doing, but the really magical thing, and I think it's what still drives me today, was the reaction of the students," he said. "What this course can do, however it's taught, is validate big questions" — *How did we get here?* for instance, or *Where are we going?* — "that are impossible to even ask within a more silo-ized education."

The Macquarie course quickly became oversubscribed, and within a few years, Christian was receiving calls from other universities, asking for advice on how they might offer something similar. In 2005, he received an invitation to speak at a conference in Boothbay Harbor, Me., where he was spotted by a scout for the Teaching Company, who asked him to tape the class in their studios just outside Washington. The 48-lecture DVD set was released in early 2008. Gates was one of his first viewers.

Christian, who is 67, now travels the world as something of an evangelist for the spread of the Big History Project. (His TED Talk, "The History of Our World in 18 Minutes," has been viewed more than four million times online.) Since introducing the course to high-school students, he and Gates realized that they needed to make a few adjustments to help it catch on. They have monitored teacher feedback closely and decreased the course in size, from 20 units to 10. True to Christian's original style, however, the high-school course links insights across subjects into wildly ambitious narratives. The units begin with the Big Bang and shift to lesson plans on the solar system, trade and communications, globalization and, finally, the future. A class on the emergence of life might start with photosynthesis before moving on to eukaryotes and multicellular organisms and the genius of Charles Darwin and James Watson. A lecture on the slave trade might include the history of coffee beans in Ethiopia.

"Most kids experience school as one damn course after another; there's

nothing to build connections between the courses that they take," says Bob Bain, a professor of history and education at the University of Michigan and an adviser to the Big History Project, who has helped devise much of the curriculum. "The average kid has no way to make sense between what happens with their first-period World History class and their second-period algebra class, third-period gym class, fourth-period literature — it's all disconnected. It's like if I were to give you a jigsaw puzzle and throw 500 pieces on the table and say, 'Oh, by the way, I'm not going to show you the box top as to how they fit together.' "

One muggy and overcast afternoon last fall, I met with Gates and Christian in a conference room at the Four Seasons Hotel in Midtown Manhattan. Gates, who operates a bit like an unofficial head of state, is managed down to the precise minute by an innumerable team of handlers and schedulers and assistants. The table before him was filled with strewn papers and gadgets, a handful of folders with old-fashioned Brother P-Touch labels and two Microsoft Surface tablet computers. A plainclothes security detail stood watch in the hallway.

Gates, who is 58, was wearing a rumpled blue monogrammed shirt. He is slim and speaks in a sort of nasal staccato, often adding exclamation to sentences that might not seem to require them. But his curiosity about education is innate and at times obsessive. Without prompting, he recounted getting a bad grade in an eighth-grade geography course ("They paired me up with a moron, and I realized these people thought I was stupid, and it really pissed me off!") and the only C-plus he ever received, in organic chemistry, at Harvard ("I'm pretty sure. I'd have to double-check my transcript. I think I never ever got a B ever at Harvard. I got a C-plus, and I got A's!").

Since starting his foundation in 2000, Gates has donated about $30 billion to organizations focusing largely on global health and development. The Gates Foundation has spent more than half a billion on educational causes, which provides some context for the comparatively modest $10 million that he has personally invested in the Big History Project.

Nevertheless, Gates has insisted on tracking this venture as he would any Microsoft product or foundation project. The Big History Project produces reams of data — students and teachers are regularly surveyed, and teachers submit the results from classes, all of which allows his team to track what's working and what isn't as the course grows. "Our priority," he told me from across the table, "was to get it into a form where ambitious teachers could latch onto it."

In our conversation, Gates was forthright about the challenges the project has faced, particularly early on. Few schools had teachers who were willing or able to instruct a hybrid course; some schools wound up requiring that two teachers lead the class together. Gates, who had hoped to avoid bureaucracy, found himself mired in it. "You've got to get a teacher in the history department and the science department — they have to be very serious about it, and they have to get their administrative staff to agree. And then you have to get it on the course schedule so kids can sign up," he said. "So they have to decide, kind of in the spring or earlier, and those teachers have to spend a lot of that summer getting themselves ready for the thing." He sighed.

Perhaps the largest challenge facing the Big History Project, however, is Gates himself, or at least the specter of him. To his bafflement and frustration, he has become a remarkably polarizing figure in the education world. This owes largely to the fact that Gates, through his foundation, has spent more than $200 million to advocate for the Common Core, something of a third rail in education circles. He has financed an army of policy groups, think tanks and teachers' unions to marshal support for the new rules and performance measurements that have been adopted by 44 states. Many education experts, while generally supportive of the new goals for reading and math skills, have been critical of the seemingly unilateral way in which the policy appeared to be rolled out. The standards have engendered public anger on both the right and left, and some states, including Indiana and Oklahoma, have decided to repeal the Common Core altogether.

In March, the American Federation of Teachers announced that it

would no longer accept grants from the Gates Foundation for its innovation fund, which had already received more than $5 million from the organization. As Randi Weingarten, the A.F.T. president, told Politico, “I got convinced by the level of distrust I was seeing — not simply on Twitter, but in listening to members and local leaders — that it was important to find a way to replace Gates’s funding.” When I spoke with Weingarten last month, she elaborated on her union members’ problem with Gates. “Instead of actually working with teachers and listening to what teachers needed to make public eduction better,” she said, Gates’s team “would work around teachers, and that created tremendous distrust.”

Teachers, she continued, feared that his foundation was merely going to reduce them to test scores. While Weingarten said that she tried to work with Gates to “pierce” the animosity, she ultimately chose to part ways because “our members perceived that we were doing things in our support of Common Core because of the Gates Foundation, as opposed to because it was the right thing to do.” It was a difficult decision, Weingarten said. “Bill Gates has more money than God. People just don’t *do* what we did.”

Beginning with the Carnegies and the Rockefellers, billionaires have long seen the nation’s education as a willing cause for their philanthropy — and, with it, their own ideas about how students should learn. The latest crop of billionaires, however, has tended to take the line that fixing our broken educational system is the key to unlocking our stagnant economy. Whether it’s hedge-fund managers like Paul Tudor Jones (who has given tens of millions to support charter schools) or industrialists like Eli Broad (who has backed “blended learning” programs that feature enhanced technology), these philanthropists have generally espoused the idea that education should operate more like a business. (The Walton Foundation, backed by the family that founded Walmart, has taken this idea to new heights: It has spent more than $1 billion supporting various charter schools and voucher programs that seek to establish alternatives to the current public-school system.) Often these patrons want to restructure the system to make it more efficient, utilizing the latest technology and management

philosophies to turn out a new generation of employable students.

For many teachers, Weingarten explained, this outside influence has become off-putting, if not downright scary. “We have a really polarized environment in terms of education, which we didn’t have 10 years ago,” she said. “Public education was a bipartisan or multipartisan enterprise — it didn’t matter if you were a Republican or Democrat or elite or not elite. People viewed public education as an anchor of democracy and a propeller of the economy in the country.” Now, she said, “there are people that have been far away from classrooms who have an outsize influence on what happens inside classrooms. Beforehand, the philanthropies were viewed as one of many voices in education. Now they are viewed — and the market reformers and the tech folks — as the dominant forces, and as dissonant to those who work in schools every day. She took a deep breath and softened her tone: “In some ways, I give Bill Gates huge credit. Bill Gates took a risk to get engaged. The fact that he was willing to step up and say, ‘Public education is important,’ is very different than foundations like the Walton Foundation, who basically try to undermine public education at every opportunity.”

Gates appears to have been chastened by his experience with the A.F.T. When he speaks about his broader educational initiatives, he is careful to mention that the change he supports comes from the teachers, too. “When Melinda and I go on the road and talk to teachers, it’s just so clear there is a real hunger for this,” he said. “If you can take a teacher and give him or her the help to become a great teacher, everyone benefits: the kids, the teacher, the community, the unions. Everyone.”

Gates resists any suggestion that Big History is some sort of curio or vanity project. But some of this earlier antipathy has raised skepticism about his support of the Big History Project. “I just finished reading William Easterly’s ‘The Tyranny of Experts,’ ” says Scott L. Thomas, dean of the School of Educational Studies at Claremont Graduate University in California. “It’s about philanthropists and their effect on the poor globally. It’s this exact idea that here you have this ‘expert’ in the middle” — that is,

Gates — "enabling the pursuit of this project. And frankly, in the eyes of the critics, he's really not an expert. He just happens to be a guy that watched a DVD and thought it was a good idea and had a bunch of money to fund it."

Diane Ravitch, an education historian at New York University who has been a vocal critic of Gates, put even it more starkly: "When I think about history, I think about different perspectives, clashing points of view. I wonder how Bill Gates would treat the robber barons. I wonder how Bill Gates would deal with issues of extremes of wealth and poverty." (The Big History Project doesn't mention robber barons, but it does briefly address unequal distribution of resources.) Ravitch continued: "It begins to be a question of: Is this Bill Gates's history? And should it be labeled 'Bill Gates's History'? Because Bill Gates's history would be very different from somebody else's who wasn't worth $50-60 billion." (Gates's estimated net worth is approximately $80 billion.)

On some level, Gates's experience in pushing through the Common Core seems to be a large part of what so excites him about the Big History Project: This small initiative, largely unburdened by bureaucracy, relies on technology and teachers who are willingly submitting to all matter of data analytics. He is pleased, he said, that the course has more than doubled in each of its first three years, and he expects that growth to follow in the future. One day, perhaps, Big History might even become a successor to Western Civ and World History. "The current thought is that in another three years, the quality of the material, the tools that let people add in new chapters and things, the broad awareness will be such that the community takes it over, and it achieves whatever natural level it's going to get to," he said. But he also noted that Big History — which is already being offered in South Korea, the Netherlands and, of course, Australia — had significant global potential. "It would be nice to find both educators and philanthropists[in foreign countries] that want to carry the torch — which actually, in some countries, I can think of people who would do it."

One morning, I entered a second-floor classroom at the Brooklyn School for Collaborative Studies, a public school in Carroll Gardens not far

from the Brooklyn-Queens Expressway. Brooklyn Collaborative Studies adopted the Big History Project as a pilot two years ago after Scott Henstrand, a longtime science teacher, watched Christian's TED Talk. He pitched the idea to the school's principal, Alyce Barr, and won her over.

As class came to order and 30 or so teenagers scurried to drop their bags and take their seats, Henstrand introduced the day's topic: "extinction events," or why and how various life-forms have died out. He asked his students to contemplate their own extinction event — a somewhat heady question for the teenage mind. As they pondered their eventual nonbeing, Henstrand put on a short video lecture by Christian and took a seat among the students, whom he had clustered in groups of four. Afterward, they were handed iPads with which to generate facts to support their various arguments about human extinction, based on how other species had expired. "I felt that it was great to be able to have your own opinions and then share it with everyone and take in other people's opinions and use everything that you compile to create new theories and new ideas, and in a way create your own sense of your own belief system," said Benjamin Campbell, a senior. One of his classmates, a junior, overheard him and chimed in: "At first I hated it, because I was like, 'I hate science.' But it actually just opened my perspective that I never knew about. I wasn't looking forward to it at all, and then I grew to love the class."

Not all educators are so enthusiastic. Sam Wineburg, a professor of education and history at Stanford, told me that although he sees Big History as "an important intellectual movement," he did not consider the class to be a suitable replacement for an actual history course. "At certain points, it becomes less history and more of a kind of evolutionary biology or quantum physics. It loses the compelling aspect that is at the heart of the word 'history.' "

Wineburg's deepest concern about the approach was its failure to impart a methodology to students. "What is most pressing for American high-school students right now, in the history-social-studies curriculum, is: How do we read a text? How do we connect our ability to sharpen our

intellectual capabilities when we're evaluating sources and trying to understand human motivation?" he asked. "When we think about history, what are the primary sources of Big History? The original scientific reports of the Big Bang?" Wineburg, who also has developed an electronic history curriculum, scoffed.

Barr, the principal in Brooklyn, however, came to feel that Gates's course was better than the existing alternative. "If you were to interview many, many progressive social-studies teachers, they would tell you that World History is a completely flawed course. It's spotty. It's like fact soup. Kids don't come out of it really having a sense of *global* history," she told me. "So I said, 'Why are we doing this?' " Last year, Barr allowed the Big History Project to replace World History, which is known as Global Studies in New York, as a required course.

At the end of class, after Henstrand announced the homework assignment, he chatted for a few minutes about the future of the course. He was cautiously optimistic that it would catch on, but he also seemed to recognize how hard it is to innovate in the educational system. "I think many are driven by it, but there are also some that are like: 'Oh, God, how do we fit this into the requirements of the day? How do we fit this and that?' " he said. "This course is a fundamental shift in how you deliver something. But there's so many factors in American education that work against it."

In many ways, education is a lousy business. Teachers are not normal economic actors; almost all of them work for less money than they might fetch in some other industry, given their skills and advanced degrees. Students are even weirder economic animals: Most of them would rather do something else with their time than sit in a room and learn algebra, even though the investment is well documented to pay off. By the same token, attempts to paint Bill Gates as a self-interested actor in his education projects don't make much sense. Joel Klein, the former chancellor of the New York City Department of Education, who charged Microsoft with being a monopoly while a lawyer at the Justice Department, laughed off the idea that Gates had an ulterior fiscal motive. "The notion that he has an agenda

other than trying to improve education is just embarrassing," said Klein, describing how Gates continued to contribute — and even increased his contributions — to New York City public schools during Klein's tenure. "I can't think there is a malevolent bone in his body."

As I walked to the subway, I thought back to my conversations with Gates. Big History may one day become an heir to Western Civ or World History, but that didn't seem to be Gates's goal; it was more personal. Really, Big History just seems like a class that he wished he could have taken in high school. But he wasn't a billionaire then. Now, a flash of inspiration on the treadmill might just lead to something very big.

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A version of this article appears in print on September 7, 2014, on page MM30 of the Sunday Magazine with the headline: Everything Is Illuminated.

The New York Times | http://nyti.ms/1qyoJbH

The Battle for New York Schools: Eva Moskowitz vs. Mayor Bill de Blasio

By DANIEL BERGNER SEPT. 3, 2014

One afternoon this summer, Eva Moskowitz, who runs Success Academy Charter Schools, showed me her senior yearbook. “I was the editor,” she said. We sat in a half-furnished office at the construction site of her charter network’s first high school. A buzz saw shrieked in the background. She graduated in 1982 from Stuyvesant, the most selective of New York City’s public high schools. “I got completely engaged in how to take this sentimental book and make it a much bigger project.” She fought to publish photographs capturing the political protests of that time — against nuclear weapons, against American aid to the government in El Salvador. To go with the pictures, she wrote a manifesto, concluding: “We do not live in a vacuum.”

“It took will,” she said about her yearbook triumph, in a tone that was only somewhat self-mocking. Moskowitz recalled, as well, Stuyvesant’s intractable failings. With an outrage that seemed barely abated by time, she described an alcoholic physics teacher who dozed through class, ceding instruction to an especially talented student, and endemic cheating on exams, caught by the cameras of her yearbook staff. “I thought it was my moral duty to show” the evidence “to the administration,” she said. “They were very adamant that they would investigate. They didn’t.”

At 50, Moskowitz is petite and favors tailored suits and spiked heels. She founded her first Success Academy, a kindergarten and first grade in

Harlem, in 2006 and has swiftly created the largest charter group in the city. It stretches from the South Bronx to Bedford-Stuyvesant, with nearly 9,500 students in 24 elementary schools, seven middle schools and the new high school, which opened in late August. Most students are black and Latino and poor enough to qualify for federally subsidized lunch — the kinds of children the city's regular public-school system seems all but incapable of educating. Fewer than one-fifth of black students in the city can read or do math at grade level, to take just one grim statistic.

Stepping out of the high-school office, we stood on the freshly laid linoleum in a common area. The tiles, picked by Moskowitz, have a grassy motif. In her eyes, the painted lawn hints at a college quad. There, as she envisions it, her students will soon be lingering to chat about "Hamlet" and "King Lear."

The granddaughter of a public-school typing instructor and the daughter of two university professors, Moskowitz grew up and lives in Harlem. Early on she was drawn to teaching — she recounted lecturing her stuffed animals on geography. After Stuyvesant, she went to the University of Pennsylvania and then earned a Ph.D. in history from Johns Hopkins. By 1997 she was teaching at Prep for Prep, a program in New York City for gifted minority students. She assigned her 11th graders to document the disparities between the city's cleaning of parks on the wealthy Upper East Side and its non-upkeep of a park in the Harlem neighborhood where some of them lived. She told the students to take photos and complain to the sanitation and parks departments. "We created a little bit of a ruckus," she said. "I think Prep for Prep was nervous about it. I was asked why I couldn't just do simulations." The park, she continued, got a cleaning.

During that period, Moskowitz grew consumed with the dismal performance of the city's vast Department of Education, which is responsible for schooling 1.1 million children — and with the union-guarded contracts that continue to make it nearly impossible to fire teachers for incompetence or give raises for merit. "I remember reading," she told me, turning to the protections for administrators, "that a principal had to

demonstrate ‘persistent educational failure’ to be in jeopardy of losing his job. I remember thinking, that’s crazy! *Persistent*. Like a driver would have to persistently kill people before being taken off the road!”

Moskowitz’s zeal persists to this day. My first exposure to her was at an informational gathering two years ago; my girlfriend was about to enroll her daughter in a first-grade class at a Success Academy school. I caught a glimpse of an educator who can be dismissive of anyone whose opinions differ from her own, and over the past four months, as I met with Moskowitz or watched her at work, that impatience with dissent emerged as one part of a furious and almost crazed passion. She has devoted herself to training a legion of young teachers and principals in how to conjure “world-class schools” or even, as she puts it, “educational nirvana.” Two of her own three kids attend her schools. She claims that her academies can stand up to any private school — she calls much of the teaching there “lazy.”

Her students have been performing phenomenally. In 2013, on the state exams that gauge proficiency in math and English, Success Academy schools far outscored not only the city’s regular public schools but also its most highly regarded charters, networks like Achievement First, KIPP (the Knowledge Is Power Program) and Uncommon Schools. At one of Moskowitz’s Harlem academies, the fifth graders surpassed all other public schools in the state in math, even their counterparts in the whitest and richest suburbs, Scarsdale and Briarcliff Manor. That year was no fluke. The 2014 results, released last month, put the network in the top 1 percent of all the state’s public schools in math and in the top 3 percent in English. At one Bedford-Stuyvesant academy, where 95 percent of students are black or Latino, 98 percent scored at or above grade level in math, with 80 percent receiving the highest of four ratings.

It might seem as if any New York mayor would be thrilled to have thousands of the city’s most underprivileged children educated so well. But during Bill de Blasio’s campaign last year and then as he claimed City Hall, he and Moskowitz took each other on in a ferocious political battle. They are two liberal crusaders with profoundly divergent ideas about how the mission

of aiding the disempowered should be carried out. De Blasio is essentially a populist; Moskowitz, whose network's board is filled with Wall Street one-percenters, is hardly a woman of the people. The political differences have stoked personal enmity, with de Blasio moving to block the expansion of Moskowitz's network and Moskowitz mustering her own political resources to move him out of her way. The ultimate outcome of their clash may determine the city's educational future.

Revamping public education and waging political warfare have long been intertwined in Moskowitz's life. Around the time she was at Prep for Prep, she entered a race for City Council. Two years earlier, in 1995, she volunteered on the winning Council campaign of Gifford Miller; now, as a candidate herself, she campaigned on the lamentable state of public schools. She personally made, she said, 15,000 fund-raising calls. "It was miserable." But she felt impelled. "It was a sense of fairness. I was running against a billionaire" — and an incumbent. "If I was going to lose, it was not going to be because of money."

She did lose, but in 1999, after the seat opened up, Moskowitz, a Democrat, ran again, denouncing the stranglehold that unions maintained on city schools. She prevailed despite vigorous opposition from the United Federation of Teachers, probably the most powerful organization in local Democratic politics. She was by then an outspoken advocate of charter schools — which are government-funded but independently run by nonprofit groups and accept all applicants or resort to lotteries to handle demand — and most of them do not have to employ union teachers and administrators. They operate largely outside the country's education bureaucracy.

In 2002, Miller, who was by then the Council speaker, put Moskowitz in charge of the Education Committee (a post de Blasio had also reportedly been vying for), and she convened hearings on the school system. Grilling labor leaders who called her "McCarthy-like" and city officials who at first refused to appear, she strained to get to the bottom of everything from the schools' dim reading scores to their dismal bathroom conditions.

“I thought that as chairwoman of the Education Committee, I could make a difference,” she said. But labor was too intransigent, the government bureaucracy too cumbersome and entrenched. “I kept getting more and more narrow: Well, if you can’t bring better science or better arts — I held a hearing on toilet paper. I thought, That’s going to be a winner, everyone’s for toilet paper, surely we can come together. But you couldn’t, because the administration denied” that there was a problem. “I had to go around photographing bathrooms where there wasn’t toilet paper. . . . I thought, This is not a system that delivers for children. Kids can’t wait till all the policies change. That’s going to be another two centuries.”

In 2005, Moskowitz ran for Manhattan borough president; after U.F.T. money and manpower helped defeat her, Joel Greenblatt and John Petry, philanthropists and partners in the hedge fund Gotham Capital, hired her as the chief executive of the charter network they wanted to start. The chief executive title, typical for charter heads, is a way to advertise accountability, to talk the language of business philanthropists who provide money, which helps the networks get going before they can rely wholly on per-pupil government financing. The title is a way to embrace the bottom line: Just as businesses need to show that they turn a profit, charter schools need to educate children in measurable ways.

To deliver, Moskowitz has implemented a range of strategies. The most recognizable are the ones Success Academy shares with plenty of other charter networks: uniforms for all students, long days, a no-excuses policy on homework and behavior, immediate discipline and an atmosphere of strict order. But other elements are more idiosyncratic — and more crucial. There’s her fierce engagement with literature, starting with picture books in her kindergarten curriculum. She told me she was determined to avoid the torpid sentences that flood the children’s-book market (“Scholastic should be shut down!” is her position on the publishing giant). There’s her belief that classroom discussion, whether it’s about math methods or paragraph structures and whether it’s with 7-year-olds or 16-year-olds, should consist of student voices 80 percent of the time. The best teachers talk least.

Above all, there are her exacting standards for the network's adults — the teachers she hires straight from certification programs or after stints with public schools or Teach for America and the administrators who have been promoted from her faculty. It's their intellectual capacity that is her main concern; the training sessions I sat in on this summer were less about teaching teachers to teach than about teaching them to think. I watched Jessica Sie, the associate director of literacy, lead an auditorium full of elementary- and middle-school faculty members in a discussion of the nuances in a short essay from The New Yorker. They wouldn't be using the essay with their students. But Moskowitz wants her faculty to know how to read in the deepest way, so they can model this for their pupils right from the youngest grades, when everyone is discussing "The Tortoise and the Hare."

During another training session, a principal, Abigail Johnson, coaxed new faculty members through a conversation about a Christina Rossetti poem. She later told me about her dread, a few years back, when Moskowitz subjected her and other school leaders to a written exercise on literary passages. After they turned in their assignments, Moskowitz led them in a training session. Two former teachers complained to me that Moskowitz was downright imperious. But the stringent instruction fit with one of Moskowitz's favorite themes: The failure that pervades so much of public education has little to do with the blighted backgrounds of the children and everything to do with the adults who sit at the front of their classrooms.

From the network's earliest years, Moskowitz's methods have brought quantifiable accomplishments. But it's on the new set of more challenging state exams — introduced in 2013 to align with New York's Common Core educational goals, benchmarks meant to push schools to teach analytic thinking and better prepare kids for college — that her students have truly stood out. Last year, 82 percent of Success Academy students tested at or above grade level in math and 58 percent in English, while the network's closest competitor, Icahn Charter Schools, had fewer than 60 percent passing in math and just over 40 percent in English. The other top networks

fell much further below.

"The results are truly incredible," Brett Peiser, the chief executive of Uncommon Schools, says about the scores of Moskowitz's students. "I continue to be surprised that people" — and here Peiser, who taught in a city school for five years and whose parents were 30-year veterans of the system, meant people in that system — "aren't banging down Success's door to find out how she's doing it."

Like Peiser and other charter leaders, David Levin, the chief executive of KIPP, has been visiting Moskowitz's schools to understand the instruction. "I'm blown away by the quality of the teaching and learning," he says. "What is inspiring is the intentionality of what the teacher is doing. And even more impressive is the intentionality of the kids during discussion about books or during problem-solving in math."

Outside the realm of charter schools, though, the talk about Moskowitz isn't so reverent. Her critics, like Diane Ravitch, a New York University professor and education historian, view her as a troubling general of the charter-school movement, which gained momentum around the country in the late 1990s and now numbers over 6,000 schools. Charters haven't proved to be a panacea for the ills of public education. They're hatched with all sorts of pedagogical notions, and there's little sign that over all they're better than regular public schools. Some nationwide studies put charter scores slightly above those of conventional schools, some below. But for many critics, performance is almost beside the point. To Ravitch, the movement itself is destructive; "it undermines the public's commitment to public education."

When I talked with her, Ravitch indicted the hedge-fund titans and business moguls — including Kenneth Langone, a founder of Home Depot, and the Walton family of Walmart — who put their weight behind promising charter schools, leading their boards and lending political clout. "When they call themselves reformers," she says, "it's something I gag on." What these philanthropists are all about, Ravitch says, is making themselves feel good while using charters as a halfway step in a covert effort to pull the country

toward the privatization of education. For charter opponents, liberalism is in jeopardy. And from this perspective, Moskowitz, with her results and her readiness to trumpet them, poses the greatest risk.

This threat lies near the heart of de Blasio's aversion to charters and his attack on Moskowitz's schools. He talks about how all of New York's children must be saved. He has said that the more than 170 charters in the city take resources needed for the overarching mission, robbing the many to teach the few. This moral and economic drama, pitting charter schools against conventional ones, carries extra charge in New York City because of an arrangement known as co-location. Under Mayor Michael R. Bloomberg, charter schools were readily granted free space alongside regular ones in cavernous school buildings. In this way, Bloomberg fostered Success Academy's spread. The public schools — with the United Federation of Teachers spurring the fight — have protested that sharing space causes overcrowding, though in theory charters have moved in only where enough rooms were available.

The truth about overcrowding may vary from building to building, but almost always the proposed arrival of a Success Academy has met with hostility: union members bused in by the U.F.T. to pack community meetings, people heckling and spitting at Moskowitz, U.F.T. lawsuits to stop the moves. Resistance to other charter networks has been much more tepid. The U.F.T. may harbor a vindictiveness toward Moskowitz that goes back to her Council hearings. I asked Michael Mulgrew, the president of the union, why Moskowitz stirred such anger in him and his membership. "It's her conflictual way of approaching everything," he says. "It's, 'I'm going to show we're better than public schools.' " That attitude infuriates many teachers at regular schools. When I spoke with a handful, they used words like "metastasize" and "venal" to describe Success Academy's proliferation. That Moskowitz's wealthy board members choose to highly reward her track record — her salary and bonus for the 2012-13 school year totaled $567,500 — only adds to the union's fury.

Moskowitz isn't the type to defuse the tension with the U.F.T. She isn't

given to finding common ground. She doesn't seem to see any reason to. Consistently, there is desperate neighborhood desire for her academies. Applications for Success Academy schools outstrip seats by five to one. On the state exams, the schools that share space with the network have passing rates as low as 4 and 5 percent.

On the topic of scores, the U.F.T. and Ravitch insist that Moskowitz's numbers don't hold up under scrutiny. Success Academy (like all charters), they say, possesses a demographic advantage over regular public schools, by serving somewhat fewer students with special needs, by teaching fewer students from the city's most severely dysfunctional families and by using suspensions to push out underperforming students (an accusation that Success Academy vehemently denies). These are a few of the myriad factors that Mulgrew and Ravitch stress. But even taking these differences into account probably doesn't come close to explaining away Success Academy's results.

In talking to dozens of current and former Success Academy employees and parents, the critique with the most staying power involved the schools' overly heated preparation for the state exams. A former fourth-grade teacher recounted that network employees made a minivan run to Toys "R" Us and returned to unload a mound of assorted treasures in the back of her classroom. "It was a huge pile," she says. "We called it Prize Mountain." She would remind the pupils that a good score on a practice test meant a gift from the mountain.

Teachers also chart students' results on the practice tests, posting their names and scores on classroom walls. Yet I heard from parents like Natasha Shannon, an African-American mother of three girls in Success Academy schools, that although the public posting could be painful for the children, it was important nonetheless. Shannon was the valedictorian when she graduated from a city school, only to find out when she enrolled in a community college that her education was so slipshod that she needed remedial classes. (Only 58 percent of the city's black high-schoolers graduate within four years; of those, 13 percent are prepared for college,

according to the New York State Education Department.) The experience shapes her thinking now. “Yes, she has test anxiety,” Shannon said about one of her daughters. “Yes, she has cried” after assessment results were posted. “But when I hear ‘test prep,’ I’m thinking, This is reality. People prep for the SATs, people prep to get jobs. When her name goes up on the wall in the lower group, I try to talk to her about how we use that to get better. I can’t let my kids fall into poverty. I comfort her, but I tell her: ‘I make $14.42 an hour. What are you going to do to have a better life?’ ”

For her part, Moskowitz asserts that the public charting is one aspect of the network’s emphasis on feedback, not only for the students but also for the faculty. Throughout the year, whether or not test prep is underway, scores on quizzes and writing assignments are analyzed at network headquarters. Each teacher’s outcome is tabulated, and bar graphs are instantly available to all faculty members. The teachers whose classes lag are responsible for seeking out advice from those who top the graphs, just as the students with red or yellow stickers by their names are guided to emulate the topic sentences of those whose stickers are green or blue.

Rancor between Bill de Blasio and Moskowitz grew intense as he campaigned for mayor. “Time for Eva Moskowitz to stop having the run of the place,” de Blasio told a United Federation of Teachers crowd in May 2013. Union banners hung behind him as he spoke into the microphone. “She has to stop being tolerated, enabled, supported.”

What precisely he had in mind wasn’t yet clear. Plainly, though, he was pledging to rescind the blessing Moskowitz enjoyed under Bloomberg. Success Academy’s spread “wouldn’t happen,” he said at the event, “if she didn’t have a lot of money and power and political privilege behind her” and if Bloomberg’s administration “didn’t ‘Yes, ma’am’ every single time, and that’s going to end when I’m mayor.”

Coming from behind in the primary and riding on a vow to end “a tale of two cities” — to diminish the divide between the rich and empowered and the poor and disenfranchised — de Blasio won the Democratic nomination last September. His victory in the general election was a foregone

conclusion, and Moskowitz felt herself fixed in his sights. Never one to be intimidated, she put him on notice: A month before Election Day, she shut her schools for a morning and gathered Success Academy families for a march. She marshaled other charter networks whose leaders worried that de Blasio would try to cap their numbers and charge rent at city-owned school buildings. Moskowitz and her army of 17,000 strode across the Brooklyn Bridge with placards imploring "Let My Children Learn."

She was effectively saying, These underprivileged families may be your voters in November, but they're not going to like you for long if you make the wrong moves in office. De Blasio didn't heed the warning. Bloomberg, in the waning months of his administration, approved a host of charter co-locations for the 2014-15 school year. Weeks after taking office at the start of this year, de Blasio indicated that he would honor most of them. But, he announced, three would have their space revoked. All were Success Academy institutions, including, inexplicably, the Harlem school with the math-whiz fifth graders, the one that beat Scarsdale and Briarcliff Manor. Now it looked as if the pupils and their schoolmates would have no space for the coming academic year.

Moskowitz was ready. Since Success Academy's early phases, she'd recognized the need for political muscle behind her network, and for the past two years she'd been collaborating with Families for Excellent Schools, a pro-charter advocacy group funded in part by the Walton Family Foundation, which also donates to Moskowitz's network. The group provided her with something akin to what the U.F.T. deployed, a platoon of organizers. It pays a team, including charter parents, to lobby politicians, raise the political consciousness of charter families and muster them for demonstrations. In addition, when de Blasio emerged as the inevitable mayor, Families for Excellent Schools convened focus groups and conducted polls. The results were enlightening. "What we learned," Jeremiah Kittredge, the organization's chief executive, told me, "is that data doesn't resonate." Superior test scores should play only a secondary role in rousing public sentiment. The group would be poised to fight de Blasio with the right media

campaign.

The charter movement worked on several fronts. When the mayor nixed the three co-locations in February, a charter delegation met with Gov. Andrew M. Cuomo and his aides, and soon a separate delegation, including a Success Academy lawyer, met with Cuomo's team, according to a charter advocate who was present for one of the discussions and was closely involved with the other. The movement's financial backers had been among Cuomo's major campaign contributors for several years. At a breakfast at the Regency Hotel in Manhattan in 2010, when Cuomo was the state attorney general and running for governor, he sat down with some of these financiers, including Petry, one of the hedge-fund partners behind Moskowitz's network. They prodded him gently on their educational cause. At that point and into last winter, Cuomo favored charter schools without being outspoken on the issue. But by February, something had shifted as he huddled with the charter representatives.

Cuomo — a Democrat who clings to the political center, a long way from de Blasio's populism — was disgruntled with the mayor. De Blasio was pressing the governor to raise taxes on wealthy New Yorkers to pay for a citywide prekindergarten program. The governor was all for prekindergarten but most likely didn't want his presidential aspirations weighed down because he had supported a tax increase. Cuomo presumably also wanted to keep his major donors happy. Surely he would rely on them down the line if he made a bid for the White House.

Though Moskowitz wouldn't acknowledge to me that she knew anything about the meetings, the charter advocate who was present recounted that Cuomo's aides suggested that the delegates arrange a show of force: a loud media campaign, an Albany rally. The delegates hoped Cuomo would then answer the popular cry. The advocates and aides also discussed potential legislation, which Cuomo would support at the state level to shield charter schools from a mayoral assault.

Moskowitz and Families for Excellent Schools went instantly into overdrive. The advocacy group produced a television and newspaper ad blitz

that appealed to the heart, not the head, telling of kids robbed of their "dreams and their hopes." While the ads saturated the city, Moskowitz again shut her academies, this time for an entire day in early March. In a bombardment of emails, she instructed parents that they and their children should board buses, rented by Families for Excellent Schools, that would take them to Albany to rescue the network and defend educational excellence. If the parents couldn't or didn't want to take part, the emails stated, no alternate arrangements would be made for their kids; the parents would have to find child care. The advocacy group mobilized families from various charter networks, its organizers calling and calling their contacts to make sure that the buses would be filled despite frigid temperatures and high snowbanks from a recent storm.

Over 10,000 families came together at the base of the State Capitol's steps. They wore bright yellow T-shirts demanding "Save Our Schools." They chanted, "Eva! Eva! Eva!"

Rally organizers gathered the day de Blasio was leading his own demonstration nearby on behalf of his prekindergarten tax. Moskowitz's crowd dwarfed the mayor's. Suddenly the governor was bounding down the Capitol steps, bellowing to the parents and TV cameras: "You are not alone! We will save charter schools!"

The next day, Moskowitz appeared on "Morning Joe" on MSNBC, saying, "We have a mayor in the city of New York who says he's a progressive on the one hand but wants to deny poor kids in Harlem an opportunity, a shot at life." After this emotional plea, she proceeded to the scores of those fifth graders. "This is outrageous!" exclaimed the host, Joe Scarborough, about de Blasio's decision. "It's immoral."

The governor soon negotiated a deal with legislators that guaranteed free space for most charters. Even so, Families for Excellent Schools continued the barrage of advertising: "You're not thinking about the people that you're hurting," a tearful charter mother said, addressing de Blasio. Eventually, the mayor's office called charter allies and donors, including Success Academy's board chairman, Daniel Loeb, according to an article in

The Times, asking for a truce and assuring that de Blasio wouldn't stand in their path. When I reached out repeatedly to the mayor, to his schools chancellor, Carmen Fariña, and to a senior adviser, none would talk with me. It was as if they had been beaten into silence.

Moskowitz, though, feels no calmer. If the state board that oversees charters grants her proposal for 14 new schools, she'll be in charge of 46 academies with 15,000 students by 2016. Part of her ambition is to expand beyond the city's struggling neighborhoods; in the last few years, she has opened schools — with racially integrated classrooms — on the Upper West Side of Manhattan and in Cobble Hill and Bensonhurst in Brooklyn. Park Slope and the Upper East Side are on the list for the next phase. "We want to grow as fast as we can while creating extraordinary quality," she said. But the City Council's Education Committee wrote to the state charter board this summer demanding a halt to new approvals. Four lawsuits trying to stop Success Academy continue. As Moskowitz perceives it, she remains in a state of siege, and at times she seems to believe she's almost powerless. "The experience," she told me at the end of August, "is of having to wake up every day and beg" for the space and support to carry out her mission.

That mission, she says, may eventually extend to running for mayor. She doesn't rule out a bid in 2017, an effort that would undoubtedly mean a climactic collision with de Blasio. When I asked about her plans for public education should she claim the mayor's office in the near or more distant future, she wouldn't address specifics. But as she spoke, it was easy to imagine her campaigning: "We have to face our educational crisis. Incredibly large numbers of schools are not working. There's an endless need." Moskowitz, in her mind, holds the answers.

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A version of this article appears in print on September 7, 2014, on page MM60 of the Sunday Magazine with the headline: Class Warefare.

The New York Times | http://nyti.ms/1qzU2mk

Why Flunking Exams Is Actually a Good Thing

By BENEDICT CAREY SEPT. 4, 2014

Imagine that on Day 1 of a difficult course, before you studied a single thing, you got hold of the final exam. The motherlode itself, full text, right there in your email inbox — attached mistakenly by the teacher, perhaps, or poached by a campus hacker. No answer key, no notes or guidelines. Just the questions.

Would that help you study more effectively? Of course it would. You would read the questions carefully. You would know exactly what to focus on in your notes. Your ears would perk up anytime the teacher mentioned something relevant to a specific question. You would search the textbook for its discussion of each question. If you were thorough, you would have memorized the answer to every item before the course ended. On the day of that final, you would be the first to finish, sauntering out with an A+ in your pocket. And you would be cheating.

But what if, instead, you took a test on Day 1 that was just as comprehensive as the final but *not* a replica? You would bomb the thing, for sure. You might not understand a single question. And yet as disorienting as that experience might feel, it would alter how you subsequently tuned into the course itself — and could sharply improve your overall performance.

This is the idea behind pretesting, one of the most exciting developments in learning-science. Across a variety of experiments, psychologists have found that, in some circumstances, wrong answers on a pretest aren't merely useless guesses. Rather, the attempts themselves change how we think about and store the information contained in the

questions. On some kinds of tests, particularly multiple-choice, we benefit from answering incorrectly by, in effect, priming our brain for what's coming later.

That is: The (bombed) pretest drives home the information in a way that studying as usual does not. We fail, but we fail forward.

The excitement around prefinals is rooted in the fact that the tests appear to improve subsequent performance in topics that are not already familiar, whether geography, sociology or psychology. At least they do so in experiments in controlled laboratory conditions. A just-completed study — the first of its kind, carried out by the U.C.L.A. psychologist Elizabeth Ligon Bjork — found that in a live classroom of Bjork's own students, pretesting raised performance on final-exam questions by an average of 10 percent compared with a control group.

The basic insight is as powerful as it is surprising: Testing might be the key to studying, rather than the other way around. As it turns out, a test is not only a measurement tool. It's a way of enriching and altering memory.

Many of us dread tests because we've been wounded by a few over the years, and sometimes severely. Almost everyone has had at least one lost-in-space experience, opening an exam to find a long list of questions that seem to hail from another course altogether. Vision narrows, the mind seizes; all feeling drains from the extremities. We would crawl into a hole if we weren't already in one.

Yet another species of exam collapse is far more common. These are the cases in which we open the test and see familiar questions on material we've studied, perhaps even stuff we've highlighted with yellow marker: names, ideas, formulas we could recite easily only yesterday. And still we lay an egg, scoring average or worse.

Why does this happen? Psychologists have studied learning long enough to have an answer, and typically it's not a lack of effort (or of some elusive test-taking gene). The problem is that we have misjudged the depth of what we know. We are duped by a misperception of "fluency," believing that because facts or formulas or arguments are easy to remember *right*

now, they will remain that way tomorrow or the next day. This fluency illusion is so strong that, once we feel we have some topic or assignment down, we assume that further study won't strengthen our memory of the material. We move on, forgetting that we forget.

Often our study "aids" simply create fluency illusions — including, yes, highlighting — as do chapter outlines provided by a teacher or a textbook. Such fluency misperceptions are automatic; they form subconsciously and render us extremely poor judges of what we need to restudy or practice again. "We know that if you study something twice, in spaced sessions, it's harder to process the material the second time, and so people think it's counterproductive," Nate Kornell, a psychologist at Williams College, said. "But the opposite is true: You learn more, even though it feels harder. Fluency is playing a trick on judgment."

The best way to overcome this illusion is testing, which also happens to be an effective study technique in its own right. This is not exactly a recent discovery; people have understood it since the dawn of formal education, probably longer. In 1620, the philosopher Francis Bacon wrote, "If you read a piece of text through twenty times, you will not learn it by heart so easily as if you read it ten times while attempting to recite it from time to time and consulting the text when your memory fails."

Scientific confirmation of this principle began in 1916, when Arthur Gates, a psychologist at Columbia University, created an ingenious study to further Bacon's insight. If someone is trying to learn a piece of text from memory, Gates wondered, what would be the ideal ratio of study to recitation (without looking)? To interrogate this question, he had more than 100 schoolchildren try to memorize text from Who's Who entries. He broke them into groups and gave each child nine minutes to prepare, along with specific instructions on how to use that time. One group spent 1 minute 48 seconds memorizing and the remaining time rehearsing (reciting); another split its time roughly in half, equal parts memorizing and rehearsing; a third studied for a third and recited for two-thirds; and so on.

After a sufficient break, Gates sat through sputtered details of the lives

of great Americans and found his ratio. “In general,” he concluded, “best results are obtained by introducing recitation after devoting about 40 percent of the time to reading. Introducing recitation too early or too late leads to poorer results.” The quickest way to master that Shakespearean sonnet, in other words, is to spend the first third of your time memorizing it and the remaining two-thirds of the time trying to recite it from memory.

In the 1930s, a doctoral student at the State University of Iowa, Herbert F. Spitzer, recognized the broader implications of this insight. Gates’s emphasis on recitation was, Spitzer realized, not merely a study tip for memorization; it was nothing less than a form of self-examination. It was testing as study, and Spitzer wanted to extend the finding, asking a question that would apply more broadly in education: If testing is so helpful, when is the best time to do it?

He mounted an enormous experiment, enlisting more than 3,500 sixth graders at 91 elementary schools in nine Iowa cities. He had them study an age-appropriate article of roughly 600 words in length, similar to what they might analyze for homework. Spitzer divided the students into groups and had each take tests on the passages over the next two months, according to different schedules. For instance, Group 1 received one quiz immediately after studying, then another a day later and a third three weeks later. Group 6, by contrast, didn’t take one until three weeks after reading the passage. Again, the time the students had to study was identical. So were the quizzes. Yet the groups’ scores varied widely, and a clear pattern emerged.

The groups that took pop quizzes soon after reading the passage — once or twice within the first week — did the best on a final exam given at the end of two months, marking about 50 percent of the questions correct. (Remember, they had studied their peanut or bamboo article only once.) By contrast, the groups who took their first pop quiz two weeks or more after studying scored much lower, below 30 percent on the final. Spitzer’s study showed that not only is testing a powerful study technique, but it’s also one that should be deployed sooner rather than later. “Achievement tests or examinations are learning devices and should not be considered only as

tools for measuring achievement of pupils," he concluded.

The testing effect, as it's known, is now well established, and it opens a window on the alchemy of memory itself. "Retrieving a fact is not like opening a computer file," says Henry Roediger III, a psychologist at Washington University in St. Louis, who, with Jeffrey Karpicke, now at Purdue University, has established the effect's lasting power. "It alters what we remember *and* changes how we subsequently organize that knowledge in our brain."

If tests are most effective when given sooner rather than later, then why not go the distance? Why not give the final on the first day, as well as on the last? This is the radical question that Bjork, the U.C.L.A. psychologist, has set out to investigate.

She did not actually give a comprehensive prefinal on the first day of class, in order to avoid overwhelming her students. She also decided to start with fairly basic material, conducting the study on her Psychology 100B class at U.C.L.A., which covers research methods.

She and Nicholas Soderstrom, a postdoc, gave the entire class of more than 300 students a short pretest, all multiple-choice questions, immediately before the start of some lectures but not others. "We wanted to see whether students would better remember and understand material from lectures preceded by a pretest than from lectures not preceded by a pretest," Soderstrom said.

To answer that, Bjork and Soderstrom did something clever on a cumulative final exam, which was given at the end of the course. Namely, they included on it questions that were related to the pretest ones as well as questions that were not. "If pretesting helps, then students should do better on related questions during a later exam than on questions about material we covered in the lectures but was not pretested," Bjork said. She and Soderstrom would compare students' scores on pretest-related questions with their scores on nonpretested ones, to see if there was any difference.

For example, here's a question from one of the pretests:

Which of the following is true of scientific explanations?

a. They are less likely to be verified by empirical observation than other types of explanations.

b. They are accepted because they come from a trusted source or authority figure.

c. They are accepted only provisionally.

d. In the face of evidence that is inconsistent with a scientific explanation, the evidence will be questioned.

e. All of the above are true about scientific explanations.

And here's a related question, from the cumulative test given after the lectures:

Which of the following is true of explanations based on belief?

a. They are more likely to be verified by empirical observation than other types of explanations.

b. They are accepted because they come from a trusted source or authority figure.

c. They are assumed to be true absolutely.

d. In the face of evidence that is inconsistent with an explanation based on belief, the belief will be questioned.

e. b and c above.

The students tanked all three pretests, performing no better than if they had guessed at random. Bjork and Soderstrom had expected as much. But the class received prompt feedback, attending the relevant lecture shortly after they took each of the three pretests. Those lectures in effect supplied them with correct answers to questions that had just been posed on the pretest. In previous experiments, such immediacy seemed to be a critical component: Pretests led to the most improvement when students received the correct answers reasonably soon after their guessing.

In order to gauge the effect of the testing, Bjork and Soderstrom gave a cumulative exam at the end of the 10-week course. It was the same format as the others: multiple-choice questions, each with five possible answers. The result? Bjork's Psych 100B class scored about 10 percent higher on the

related questions than on the unrelated ones. It's far from a magic memory pill — but 10 percent, as we all know, can often translate to a letter grade. "On the basis of this significant difference," Bjork said, "giving students a pretest on topics to be covered in a lecture improves their ability to answer related questions about those topics on a later final exam." Even when students bomb, she said, pretests provide them an opportunity to see what vocabulary will be used in the coming lectures, what kinds of questions will be posed and which distinctions between concepts will be crucial.

Bjork's experiment suggests that pretesting serves to prime the brain, predisposing it to absorb new information. Scientists have several theories as to how this happens. One is fairly obvious: Students get a glimpse from a pretest of the teacher's hand, of what they'll be up against. That's in the interest of not just students but of teachers, too. You can teach facts and concepts all you want, but what's most important in the end is how students *think* about that material: How they incorporate all those definitions into a working narrative about a topic that gives them confidence in judging what's important and what's less so. These are not easy things to communicate, even for the best teachers. You can't download such critical thinking quickly, hard as you might try. But you can easily give a test with questions that themselves force that kind of hierarchical thinking. "Taking a practice test and getting wrong answers seems to improve subsequent study, because the test adjusts our thinking in some way to the kind of material we need to know," Bjork said.

A second possibility has to do with the concept of fluency. Wrong guesses expose our fluency illusions, our false impression that we "know" the capital of Eritrea because we just saw it or once studied it. A test, if multiple-choice, forces us to select the correct answer from a number of possibilities that also look plausible. "Let's say you're pretty sure that Australia's capital is Canberra," Robert A. Bjork, Elizabeth Ligon Bjork's husband and a leading learning scientist, said. "O.K., that seems easy enough. But when the exam question appears, you see all sorts of other possibilities — Sydney, Melbourne, Adelaide — and suddenly you're not so

sure. If you're studying just the correct answer, you don't appreciate all the other possible answers that could come to mind or appear on the test." Pretesting operates as a sort of fluency vaccine.

Biologically, too, there may be something deeper at work. To review, memory builds on itself in ways we don't usually notice. Retrieval — i.e. remembering — is a different mental act than straight studying; the brain is digging out a fact, together with a network of associations, which alters and enriches how that network is subsequently re-stored. But guessing is distinct from both study and retrieval. It too will reshape our mental networks by embedding unfamiliar concepts (the lend-lease program, the confirmation bias, the superego) into questions we at least partly comprehend ("Name one psychological phenomenon that skews our evaluation of evidence"). Even if the question is not entirely clear and its solution unknown, a guess will in itself begin to link the questions to possible answers. And those networks light up like Christmas lights when we hear the concepts again.

And here is where pretesting shows its likely limitations: A prefinal for an intro class in Arabic or Chinese could be a wash, because the notations and characters are entirely alien. There's no scaffolding of familiar language to work with — no existing network in which to situate the new symbols — before we make a guess. We are truly lost, with no recognizable landmark. The research thus far suggests that prefinals will be much more useful in humanities courses and social-science disciplines in which unfamiliar concepts are at least embedded in language we can parse.

The word "testing" is still loaded, of course, in ways that have nothing to do with learning science. Educators and experts have debated the value of standardized testing for decades, and reforms like the No Child Left Behind law, which increased the use of such exams, have only inflamed the argument. Many teachers complain that a focus on testing limits their ability to fully explore subjects with their students. Others attack tests as woefully incomplete measures of learning, blind to all varieties of creative thinking.

But the emerging study of pretesting flips that logic on its head. "Teaching to the test" becomes "learning to understand the pretest,"

whichever one the teacher chooses to devise. The test, that is, becomes an introduction to what students should learn, rather than a final judgment on what they did not.

Correction: October 26, 2014

An article on Sept. 7 about pretesting as a learning technique misstated the given name of the author of a 1939 psychological paper on the retention of knowledge. He was Herbert F. Spitzer, not Herman.

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A version of this article appears in print on September 7, 2014, on page MM38 of the Sunday Magazine with the headline: Test Drive.
