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Who Won the Math Wars?

Nicholas Tampio

The New Math: A Political History. By Christopher J. Phillips. Chicago: University of Chicago Press, 2015. 224p. $45.00 cloth, $17.00 paper.

The Opportunity Equation: Transforming Mathematics and Science Education for Citizenship and the Global Economy. By the Carnegie Corporation of New York/Institute for Advanced Study Commission on Mathematics and Science Education. 2009. https://www.carnegie.org/media/filer_public/80/c8/80c8a7bc-c7ab-4f49-847d-1e2966f4dd97/ccny_report_2009_opportunityequation.pdf.

In the 2017–18 school year, classrooms across the country will use modules from the New York State Education Department Common Core Curriculum, also known as Eureka Math. From prekindergarten to fifth grade, students follow *A Story of Units* that "tells the unfolding story of mathematics as expressed in the [Common Core] standards—lesson by lesson, throughout each grade and over the student's entire school career."[1] The first lesson of fifth grade teaches students to "reason concretely and pictorially using place value understanding to relate adjacent base ten units from millions to thousandths." The suggested lesson structure is to use 12 minutes of class for fluency practice, 8 minutes for an application problem (provided), 30 minutes for concept development, and 10 minutes for a student debrief.[2] New York spent approximately $26 million of its "Race to the Top" grant to create its curriculum modules.[3] According to the state Education Department, between 2011 and 2015 the site had "143 million page views, 32 million downloads and more than 10 million unique visitors worldwide."[4] Pearson, McGraw Hill, and other publishers also make math textbooks; sometimes teachers create their own units, but all around the country, schools are using scripted Common Core–aligned math curricula.

For a student of American political development and education policy, the creation of a de facto national math curriculum framework is remarkable. The U.S. Constitution does not enumerate education as a federal power, and the Tenth Amendment says that unenumerated powers belong to the states. The Elementary and Secondary Education Act of 1965, as well as its most recent reauthorization, the Every Student Succeeds Act of 2015, contain provisions prohibiting the federal government from making curricula or influencing standards. In spring of 2017, U.S. Secretary of Education Betsy DeVos said "there isn't really any Common Core any more" because "each state is able to set the standards for their state."[5] That statement, however, obscures the ways that the federal government can require states to use "challenging" education standards and approved assessments and accountability systems to receive federal education funds, most notably for Title I grants used to supplement budgets in economically disadvantaged communities. In part because of federal laws and policies, students all around the country study Common Core math even if it has different names.[6] Common Core "won" the so-called math wars that have transpired in America for over a century.

According to Christopher J. Phillips in his important book on *The New Math*, "math wars" are never just about how to teach students math. Math wars determine which individuals and groups capture the commanding heights of the educational establishment and profit from the textbook, assessment, and consulting market. More profoundly, math wars rage over what it means to think correctly in math as well as in other fields, such as literature, science, economics, and history. Math is a "discipline which disciplines." Reviewing the battle over "New Math" in mid-twentieth century America, Phillips observes that descriptions of mathematical practices were also "descriptions of forms of reasoning"; debates about pedagogy affected "the sort of reasoning applicable most widely and virtuously outside the classroom"; and battles about curricula hinged on "evaluations of intellectual, social, and political order" (p. 21). Renewing a line of argument that goes back at least to Plato, Phillips contends that how you teach children math shapes how they think

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as political subjects. Do you teach children to obey authority or think for themselves? This is equally a pedagogical and a political question.

In his book, Phillips describes an earlier stage in the math wars, intimating that it will help us make sense of the row over the Common Core (pp. 8–9). Here, I pursue that intimation and consider how the Common Core prevailed in the math wars and what that means for American democracy and education. If New Math failed in part because it paid too much respect to America's tradition of state and local education control, Common Core math won because it has powerful backers in private foundations and the federal government. This victory, however, may come at a steep cost: according to its critics, Common Core math will not introduce most students to sufficient trigonometry, precalculus, or calculus to major in a science, technology, engineering, or mathematics discipline in college and then pursue a STEM career. Despite the rhetoric about preparing students for prestigious colleges and careers, Common Core may only prepare most students to enter community college and low-skill jobs. The New Math and Common Core fiascos suggest that democracies should have space for contending visions of how to teach mathematics and other academic topics.

The Battle Over New Math

The New Math is a history of an education reform movement that started in the mid-1950s and ended about two decades later. The book is also a methodological treatise on how people may study and participate in ongoing curriculum debates. In this section, I highlight the questions that Phillips suggests that we ask in our own time, an exercise I will undertake in the next section.

How was the problem framed? Histories of American education often discuss how the Soviet launch of Sputnik in 1957 began a cascade of events leading to New Math: the passage of the 1958 National Defense and Education Act (NDEA), which funded the National Science Foundation (NSF), which in turn supported the School Mathematics Study Group (SMSG) to write new textbooks. Many Americans at the time used the rationale that Americans needed a new math curriculum to win the "Cold War of the classrooms" (p. 22). Phillips adds that partisans of New Math thought that mathematics educators argued, even before Sputnik, that America needed to reform its math instruction to "prepare citizens for modern society, for a world of complex challenges, seemingly rapid technological changes, and unforeseeable future conflicts" (p. 5).

Who led the reform effort? Edward S. Begle, a professor of mathematics at Yale who moved to the education school at Stanford, led the New Math movement. The SMSG originally had an Advisory Committee of eight academic mathematicians. It enlisted hundreds of writers to produce curricular units, and partnered with organizations, such as the Mathematical Association of America and the National Council of Teachers of Mathematics, that included thousands of mathematicians and math educators. Leaders of the NSF originally wanted to focus on securing government aid to fund graduate fellowships and research, but then Congress funded the NSF and SMSG to transform the middle and high school, and then elementary, textbook markets. If the Cold War created the political context and Congress provided the money, "the responsibility for the federal reform of mathematics education ultimately fell to a handful of mathematicians and teachers" (p. 44).

What was the philosophy of education? Today, many people think of New Math as "fuzzy math" that shares progressive education's disdain for procedural mastery. The irony is that New Math sought to displace progressive math education. Following in the footsteps of the French Bourbaki movement, New Math stressed "precise terminology, the modernization or elimination of 'vague' concepts like spatial intuition, the importance of well-chosen axioms, and above all, the placement of structure at the center of mathematical practice" (p. 51). A defining feature of New Math was that it began with sets rather than numbers in order to prepare students to think of math as "a set of interrelated, abstract, symbolic systems" (p. 67). The goal was to prepare students to think like modern mathematicians.

How did the reform succeed? New Math published millions of textbooks, teacher manuals, and monographs. Its leading organization, the SMSG, served "as a clearinghouse for various curricular reforms and education initiatives, as well as providing the infrastructure by which new mathematics curricula were tested" (p. 3). New Math advocates were careful to respect the country's tradition of state and local control and hesitated to mandate or even provide a fully developed curriculum. Instead, New Math spread because of the prestige of its leaders, as well as its practice of inviting hundreds of educators to write books and grade tests, therefore becoming potential ambassadors for New Math.

How did the reform fail? New Math did not become a toxic brand by the mid-1970s because it had failed to teach children math. The political environment, Phillips explains, caused the demise of New Math. After the Vietnam War and Watergate, Americans did not trust the kinds of experts who made the New Math. Schools around the country would use certain New Math textbooks until the 1990s, but New Math would become a cautionary tale that later math education reformers would have to study.

The Battle Over the Common Core

The math wars did not end when the SMSG closed its doors in 1972. In the immediate aftermath, the country witnessed a "back to basics" movement, often led by grassroots conservatives, that emphasized computational mastery over conceptual understanding. In 1989, the National Council of Teachers of Mathematics published

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the *Curriculum and Evaluation Standards for New Mathematics*, which structured much of American education for the 1990s and the early 2000s. Here, I take up the story with the origin of the Common Core in the early days of the Obama administration, focusing on a 2009 report commissioned by the Carnegie Corporation of New York and the Institute for Advanced Study called *The Opportunity Equation: Transforming Mathematics and Science Education for Citizenship and the Global Economy*. This report gives us insight into what Common Core advocates were thinking in the year that the National Governors Association (NGA) and Council of Chief State School Officers (CCSSO) released the first draft of the standards.

How was the problem framed? According to *The Opportunity Equation*, students need to learn about the beauty and wonder of math and science and learn the subjects as part of a liberal arts education. The primary justification for reforming math and science education, however, is economic: "The nation's capacity to innovate for economic growth and the ability of American workers to thrive in the global economy depend on a broad foundation of math and science learning" (p. 1). The country needs a new education system to lead the best students to innovate and everyone else to prepare for careers that require some familiarity with science, technology, engineering, and mathematics. If the New Math arose because of Cold War concerns about security and a docile citizenry, the Common Core gained traction because it promised to prepare children for college and careers.

Who led the reform effort? Political scientists have explained how the federal government has increasingly played a role in education reform efforts, including the No Child Left Behind Act of 2001 that required states to adopt education standards and aligned assessments and accountability mechanisms.[7] The policy entrepreneurs who seized the moment to create national education standards, however, were David Coleman and Jason Zimba. Coleman and Zimba had started a company, the Grow Network, that produced assessment reports of standardized test scores; they also wrote a report for the Carnegie Corporation calling for "Math and Science Standards That Are Fewer, Clearer, and Higher to Raise Achievement at All Levels." Coleman and Zimba would become lead writers of the Common Core English Language Arts (ELA) and mathematics standards, respectively. They, in turn, assembled writing teams, work groups, and feedback groups to refine the standards, and then brought in major groups, with the financial backing of the Bill and Melinda Gates Foundation, to promote the standards.[8]

What was the philosophy of education? The Opportunity Equation announces an end to the math wars: "Mathematics education has long been divided by contentious debates about curriculum and instruction. A breakthrough occurred with the 2005 Common Ground project, sponsored by the Mathematical Association of America, which brought together scholars and educators representing different orientations. They produced a set of understandings that all could agree to" (p. 22). The report says that the forthcoming standards will combine the proficiencies that supposedly all the camps agree are important: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and a productive disposition (pp. 24–25).

How did the reform succeed? Most states adopted the Common Core standards in 2010 and 2011 in order to gain points on their Race to the Top application. The Obama administration administered Race to the Top as a competitive grant program using over $4 billion of discretionary funds from the American Recovery and Reinvestment Act. Race to the Top did not force states to adopt the Common Core, but it did incentivize states to adopt the standards to receive additional federal education aid at the height of the Great Recession. The Every Student Succeeds Act (ESSA) explicitly prevents the secretary of education from interfering in a state's decision about education standards, but it also requires states to "provide assurances that they have adopted 'challenging' academic standards in mathematics, language arts & science" and that the standards "must be aligned to college and career/technical education standards."[9]

How did the reform fail? In 2013, 83% of survey respondents for an Education Next poll supported the Common Core standards; four years later, the number is 50%. Democrats tend to support Common Core more than Republicans, but the level of support has dropped precipitously among the public, teachers, and members of both political parties. A number of Common Core advocates note that many people still like the idea of national education standards, and the Common Core standards in particular, but dislike how the federal government pressured states to adopt the standards.[10] Common Core opponents argue that the rebranding strategy will not work. We do not know the long-term future of Common Core math.

The Sticky Floor Critique

Partisanship played a part in opposition to the Common Core. At the same time, the Common Core expresses a certain philosophy of mathematics—and, by implication, a conception of correct reasoning in many areas of life—that reasonable people may find objectionable. For instance, Richard R. Phelps and R. James Milgram make what I call the "sticky floor" critique, namely, that the Common Core makes it hard for many students to study advanced mathematics.[11]

According to Phelps and Milgram, the Common Core math sequence "is dreadful preparation for college" and subsequent careers in STEM. The Common Core stops, for most students, at an Algebra II course and does not cover much trigonometry or any precalculus or calculus: the Common Core's coverage of algebra "is minimal, with

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neither logarithms nor conic sections adequately covered to say nothing of the analysis of rational functions and preparation for the partial fraction decomposition of rational functions. All are standard high school topics in a traditional Algebra II course, and are essential for STEM and related majors in college."[12] The Common Core math standards "are not equal in rigor to their international peers; in fact, they leave American students well behind them. Worse yet, the [Common Core math standards] unambiguously *lower* standards in high school mathematics."[13]

One response to this criticism is to say that the Common Core standards create a floor that guarantees that all children are numerate but that mathematically gifted students can soar above the floor, particularly in high school. The problem, Phelps and Milgram explain, is that virtually all American students in grades 3–8 and in high school must take high-stakes Common Core math tests. Race to the Top funded the creation of the Partnership for Assessment of Readiness for College and Careers (PARCC) and Smarter Balanced Assessment Consortium (SBAC) Common Core tests that students in many states take each year; and the alignment of the SAT and ACT tests with the Common Core mean that students must focus on the Common Core K–8 standards to graduate from high school (in some states) or earn admission to institutions of higher education (in most states). Because the Common Core-aligned "SAT and ACT tests will cover, at best, only the first two years of a high school curriculum (that is as far as the [Common Core math standards] go, despite all the misleading rhetoric about how advanced they are), they will incentivize our students to learn nothing beyond what is in a junior-high-school level curriculum in high-functioning education systems."[14]

In other words, the Common Core sets a floor, but it is a "sticky floor" that many administrators, teachers, and students will not have any incentive or leverage to leave. The Common Core, in reality, means that fewer American students—particularly from low socioeconomic-status school districts that cannot afford to offer coursework beyond the Common Core—will be prepared to fill the U.S. STEM pipeline.

Federalism and the Math Wars

How may the country escape this conundrum? The Every Student Succeeds Act (ESSA) states that the Secretary of Education "shall not attempt to influence, incentivize, or coerce State adoption of the Common Core State Standards."[15] As of 2015, however, most states had already adopted the Common Core standards. The pertinent question is whether the federal government will help or hinder states trying to adopt another set of education standards. On March 13, 2017, Secretary of Education Betsy DeVos commended the Council of Chief State School Officers (CCSSO) and the National Governors Association (NGA) for helping each state develop its consolidated ESSA plan.[16] The CCSSO and the NGA are the two sole owners of the Common Core State Standards, and as of the summer of 2017, no state that had adopted the Common Core had chosen to adopt a substantively different set of education standards. In fact, the Department of Education surprised many observers with its detailed critiques of state ESSA plans, despite the Trump administration's promise to return local education control to the states.[17] The Trump administration, like the Obama administration before it, is apparently using the power of the federal government to lock states into using Common Core standards.

Under the Trump administration, many Democrats are apparently (re)discovering the virtues of federalism whereby cities and states may thwart the ambitions of the federal government. Hopefully, this orientation lasts through and beyond the Trump presidency, as Democrats and Republicans see the wisdom of distributing education authority widely throughout the country. The Common Core math standards arguably lower the quality of education for many students in the country and undoubtedly alienate many parents and citizens from the political process where they feel (rightly) that they do not have much voice. The advantages of having national math education standards do not outweigh the pedagogical and civic disadvantages. The correct lesson of the New Math and Common Core debacles is that policymakers ought to let people across the country agree to disagree on the best way to teach mathematics and other academic topics.

It is to be hoped that in the future, historians will research the Common Core with as much care as Phillips has investigated the New Math. By way of conclusion, I note one final aspect of the Common Core State Standards Initiative that differentiates it from the New Math push. Joanne Weiss, director of the Race to the Top program, explained that "the development of common standards and shared assessments radically alters the market for innovation in curriculum development, professional development, and formative assessments. Previously, these markets operated on a state-by-state basis, and often on a district-by-district basis. But the adoption of common standards and shared assessments means that education entrepreneurs will enjoy national markets where the best products can be taken to scale."[18] Eureka Math, for instance, is the most widely used math curriculum in the United States. Though the modules are free, Great Minds offers Eureka Math professional development (PD) and sells a wide variety of print materials, digital resources, and manipulatives.[19] In 2015, the Wall Street Journal estimated that more than $7 billion had already been spent on the Common Core that would have been spent anyway on testing, curricular materials,

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technology, and training. One may rightly speak of a Common Core goldrush.

Phillips notes that New Math advocates wanted for-profit publishers to make aligned textbooks. According to Phillips, however, New Math leaders respected the American federal system with its constitutional prohibitions on centralized education authority. The New Math may have fallen, in part, because its leaders still respected democratic procedures for the ways in which states and localities make curricular decisions. Common Core advocates, however, leveraged the power of the federal government and billionaire philanthrophy to create a market where education entrepreneurs stand to make fortunes. Who won the math wars? Follow the money.

Notes

1 EngageNY, "How to Implement *A Story of Units*."
2 EngageNY, "New York State Common Core Mathematics Curriculum: Grade 5, Module 1."
3 New York State Education Department, "New York State Race to the Top Phase 2 Application," 352.
4 New York State Education Department, "New York State Race to the Top Executive Summary," 5.
5 Ujifusa 2017a.
6 Sparks 2017.
7 See McGuinn 2016.
8 See Garland 2014; Lyndsay Layton, 2014, "How Bill Gates Pulled Off the Common Core Revolution," *Washington Post*, June 7.
9 New York State Education Department, "Every Student Succeeds Act (ESSA) Orientation."
10 Education Next 2016.
11 R. James Milgram is professor of mathematics *emeritus* as Stanford University. He was a member of the Common Core's Validation Committee and refused to sign off on the standards. Another member of the committee, Sandra Stotsky, is a prominent critic of the Common Core English Language Arts (ELA) standards.
12 Phelps and Milgram 2014, 21.
13 Ibid., 5.
14 Ibid., 25.
15 Every Student Succeeds Act 2015.
16 DeVos 2017.
17 Ujifusa 2017b.
18 Weiss 2011.
19 Great Minds, "EngageNY Is Eureka Math."

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