Algebra and Civil Rights
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Algebra 2 Hurts. I recall when, forty years ago, activist educator Bob Moses taught us that algebra is a civil right because it functions as a gateway to so many opportunities in secondary and postsecondary education.

That sounded right to me, generalizing from the racially disparate tracking in my own public schooling in the 1960s. The Moses narrative was about access in a practical sense; it wasn't mere aspiration, or fake implementation. (Yes, our school offers the course but there isn't room for you and, anyway, it conflicts with the English course you need.) Ensuring universal access to Algebra 2 seemed fundamental. And still does.

But three years ago, a colleague introduced me to research on the racially disparate impact of math requirements on the attainment of minority and poor students. It was immediately clear to me from Pamela Burdman's work that although Algebra 2 could be a path to opportunity it could also be a barrier—an unnecessary one.

College admissions and transfer requirements often include mastery of some level of mathematics. As implemented, many students can be trapped in non-credit, remedial courses; mounting discouragement lowers the odds of completing a degree. Indeed, the requirements for admission may push students to forego college altogether.

We should update the principle that algebra is a civil right by asking, instead, whether the purposes and benefits of requiring Algebra 2 justify the reduction in opportunity.

When I first pondered these questions, I immediately thought about Title VI of the Civil Rights Act of 1964, which prohibits discrimination by recipients of federal funding, like public schools. So, imagine that a policy is race and ethnicity-neutral in design and as articulated. Nevertheless, it has a disparate impact. Then that policy is illegal discrimination unless the employer or federal grantee can present convincing evidence that the policy is needed and that no alternative would be comparably effective with less disparate impact. There is no need for evidence of discriminatory intent or animus.

So, algebra requirements have a civil rights problem. The data clearly establish substantial racial/ethnic disparate impacts in most diverse jurisdictions, because our K-12 system is itself

rife with disparities and inequity. The law asks whether requiring Algebra 2 is an educational necessity, with no alternative. For English majors? Why not statistics instead?

I need to take a detour back to 1996. A federal appeals court struck down a race-conscious affirmative action policy at the University of Texas, finding it discriminatory against Anglos. Civil rights advocates did not appeal to the Supreme Court at the time, feeling that the Texas plan was indefensibly close to a mechanical quota. But we knew university affirmative action would eventually come before the Supreme Court. My Harvard colleague Gary Orfield and I convened 90 prominent leaders from higher education, research, advocacy, and federal civil rights enforcement. At the meeting, the lawyers among us explained to befuddled participants that the Supreme Court would not be impressed by lofty pronouncements from a bunch of university presidents asserting that their institutions have a *compelling interest*—that's the Constitutional test—in diversity. Cheerleading is not evidence.

We asked ourselves, what evidence might researchers provide to defend affirmative action in the conservative Supreme Court? What would show whether diversity enhances education or prepares students for life after the university—the dual mission of colleges? At the meeting, we developed some answers, several people spent years doing the research, and Justice Sandra Day O'Connor cited the research in her 2003 opinion of the Supreme Court upholding a flexible form of affirmative action at the University of Michigan. Lofty assertions were important in that case, but only because there was accompanying research.

End of detour.

Is Algebra 2 Necessary, in a Legal Sense? With respect to math education, we must ask: What kind of research would demonstrate that Algebra 2 is an educational necessity for college achievement or attainment? For the history major, not just STEM major peers? In both cases— the necessity of Algebra 2 or the necessity of diversity—there is a clash between what seems intuitively obvious to one group of decision makers, but is not at all obvious to another group. Another group that, for better or worse, is willing to question established practices in order to reconstruct opportunity in our society. This is an issue we are working on at my organization, The Opportunity Institute, through a project called Just Equations led by Pam Burdman.

When I was an undergraduate math major at Swarthmore College, I served on a committee reconsidering distribution requirements. I read about an interesting debate decades earlier about the college's tough language requirement: two years each of Greek and Latin. The debate way back then was: Why do we need our graduates to know so much Latin and Greek? For earlier generations, there was a strong consensus among elites about what it meant to be an educated person. Somehow that consensus was disrupted.

Algebra 2 is an almost identical case. When inquiring about its purpose, many have claimed that students need it to be an educated person. (Although some others consider the get-through calculus imperative a device to create jobs for math teachers and professors, lest they follow the path of Latin and Greek professors. Or go to law school.)

In antidiscrimination law, however, lofty pronouncements or sturdy tradition do not suffice to justify an otherwise prohibited disparate impact. There should be evidence and a burden of persuasion for policies such as general education or transfer requirements. Where feasible we should prefer research to professional prejudices or elitist traditions. Indeed, that possibility of disruption has been the broad purpose of antidiscrimination law from its beginnings in the post-Civil War amendments to the Constitution. Putting the law aside, it's just decent and fair to be extra careful when adopting or defending a policy that works to the detriment of an identifiable group of students who need more opportunity, not less.

My favorite hobby, pathetic though it may be, is serving on committees of the National Research Council, the operating arm of the National Academies of Science, Engineering and Medicine. Several assignments have touched on issues of validity in testing, assessment, and standard-setting. The basic idea is that if we're going to make some population take a test, the test must be valid in this technical sense in order for us to make judgments that are useful and scientifically sound.

The predictive validity of a test, licensing requirement, or performance standard is about making good predictions of something that's useful. For a math requirement or an employment test, it's the same idea. You can't require a high school diploma for a job sweeping floors if the diploma is a poor predictor of job performance. *We should not require Algebra 2 if it's a poor predictor of college GPA or completion, or if other things are at least as good at predicting but do so with less disparate impact.* That, I'm pretty confident, is the state of civil rights law today.

The critical point is that the research demonstrates—and it's only getting stronger—that there are alternative math pathways that are as predictive or more predictive of success in college … with less or no disparate impact. (Prominent examples include *Statway,* developed by the Carnegie Foundation for the Advancement of Teaching and now based at WestEd, and the Dana Center Mathematics Pathways, which originated at the University of Texas.) The logic of civil rights, the logic of equity, tells us that we should use alternative selection devices, rather than the one that has a disparate impact.

Opportunity Conundrum. But now I want to go back to the other major purpose, which is math instruction as a way of opening up opportunities. Coming out of an era in which it was commonplace for poor and minority kids to be deprived of the opportunity to take math, requiring Algebra 2 in high school was a very useful way of making that history, well, a thing of

the past. The math requirement was thought tantamount to requiring access to more and better options, both academic and career.

In a given context, which way lies opportunity? Which way lies equity for most children? Eliminating the Algebra 2 requirement, say for high school graduation, will lower a barrier, boost attainment, and increase opportunity. But not taking Algebra 2 will also eliminate what is available to a student in the future, including admission to many colleges, thereby decreasing opportunity. Plus, eliminating the requirement, history warns us, will lead some school districts to ration math education. Inequitably.

I think we resolve this conundrum as follows. On the one hand, we want to delay as long as possible the moment at which 9th grade Maria has to choose her future. Concomitantly, we want to delay as long as possible the moment at which she can change her mind about whatever future she selects initially, or defaults into. To be a little more specific: Suppose that instead of taking Algebra 2, Precalculus, and Calculus, Maria takes Math Modeling and Statistics because she wants to be a journalist, or they just seem more relevant. But a year or two later, her dream changes. She wants to be an engineer.

Is there a way, through co-requisites or otherwise, to establish curricular bridges to the path she now understands is right for her? Can we postpone the moment when it's too late for Maria to reinvent her future? The research hypothesis is that the likelihood of Maria switching paths toward STEM will be greater if she has access to bridge courses. Another way of thinking about it is, we have to decide what's exogenous and what's endogenous. If we take high school and college curricula *or* requirements as they stand—as immutable—then we're in a prison. But it's a prison in our minds, not in the math. We put ourselves there.

In fairness, we are a lot better than societies where your fate is determined by a test you take in sixth grade. But now the question is: Can we become a society in which what you take in 11th grade *does not* determine so much of your fate, including college attainment? A society in which there are opportunities to get back on the on-ramp that leads to the future you choose? Those on-ramps must be built by teachers of mathematics, like those of you in this room. Then it becomes more feasible to remove barriers and expand opportunity. This construction project complements many things other education leaders are working on: academic and career counseling, intensive outside-school-time programs, tutoring, and other measures to help students succeed.

Surely We *Need* Algebra. What I want to challenge math teachers and the rest of us about is the politics of deciding what's important—the traditions about what's important mapped against the realities of what students need for themselves and our economy. In my own view, there are not only instrumental reasons for math achievement and attainment. There are, for starters, the traditional reasons of liberality, the idea that this broadens you as a person, opening you up to

learning throughout your life. (Although I suppose the same might be said of studying classical Latin or Greek.)

Deciding what a liberal education requires is political judgment. It's not really a judgment for a math department to make. Math departments are made up of people who haven't spent much time in the real world, and usually prefer not to. So, who are they to decide what's required to be liberal, in a liberal arts sense? (And there's that debate about whether liberal arts is an outdated, elitist construct anyway. But that's a different talk.)

Instrumentalism, and liberality. But a third reason, and the reason I love math, is the aesthetic or even spiritual aspect of it. When asked why I majored in math, I always explain that you can see God in Euler's Identity. ($e^{i\pi} + 1 = 0$). If I was making a decision about how much math everyone should have it would be a lot, just because of its beauty. On the other hand, we don't generally make art history a requirement for matriculation or graduation, so I suppose I should keep my spirituality to myself.

Conclusion. I'm in this because the data showed that tens of thousands of California students—most black, Latino, or poor—were dropping out of public postsecondary education *every year* because they couldn't get past the math requirement—a math requirement that had never been subjected to any kind of validity study, only subjected to faculty club conversations about what students might need if they're going to be a biology major or want to be a physician. And the typical self-referential answer was probably some form of, "What worked for me …." That framework practically invites exclusionary policies.

Mathematicians, probably more than any other group, ought to be able to look at this issue of what should be required and what should not in a cold-eyed analytical way. Mathematicians ought to be able to strip away cultural preconceptions and, instead, create a responsible and responsive framework for deciding what's important and what's not.

The lamest excuse in almost every setting is, "Because that's the way we've always done it." Going back over 20 years to the Supreme Court and planning the defense of affirmative action, the president of Harvard said in our meeting, more or less, Harvard has a compelling interest in diversity because, "We've always cared about diversity." My first rejoinder: False. Second rejoinder: So what?

And now, what's that about the quadratic equation?