Five-Step Process: Step Five

by Bill Crombie, Aidan Soguero

“The Five-Step Curricular Process

1. Conjecture/Explore
2. Picture/Model
3. Picture/Model
4. Picture/Model
5. Symbolic Representation

Imagination is more important than knowledge. For knowledge is limited, whereas imagination embraces the entire world, stimulating progress, giving birth to evolution.” - Albert Einstein

The ultimate goal of the Five-Step Curricular Process is to guide students to a place in which their own, intuitive understanding of the world includes a fluency in the computational processes and symbolic representations of mathematics. Rather than have them commit a semester to rote memorization, the process allows the mathematics to be found inside their everyday lives. Beginning from a shared physical experience to modeling it to discussing it as a group allows them to negotiate the details of their ordinary experiences. By discussing the event’s features, they begin to conceptualize a more formal and specific way of communicating mathematical or logical concepts. Finally, the students are asked to represent what they have done symbolically.

Another major aspect of the Five-Step Curricular Process is to stimulate creativity, imagination, and student agency. It is important that the process allows students to view themselves as mathematicians, and that their own ideas and ways of conceptualizing math are important. After all, if one were to follow the infinite regress of proofs and axioms all the way down, the reason we do math the way we do is simply because it’s the best way anyone at the time could imagine.

This is important to note because while, in Algebra Project classrooms, the Symbolic Representation step does sometimes include traditional mathematical notation, it also sometimes doesn’t. It is incumbent on the students to determine what kind of notation makes sense to them and what they think will make sense to their peers.

Destini Chambers used musical notation. (Cont’d on page 4)


**Quality Public Education For All: Do We Want It?**

By Robert P. Moses with Charles E. Cobb Jr.

New Introduction by Ben Moynihan

(An alternate version of this essay was published in the May/June 2001 (Volume 17:3) issue of the Harvard Education Letter as “Quality Education Is a Civil Rights Issue”)

It strikes me that Bob and Charlie’s writing remains relevant to issues at the heart of current education reform discussions in America, imploring us to attend to the promise of equal opportunity for all, just as when they wrote it in 2001. Their incisive critique of policies aimed at moving Black students instead of fixing all schools, which has prevailed in these almost 70 “all deliberate speed” years since the 1954 Brown v. Board of Education U.S. Supreme Court decision, remains prescient today. The students, teachers, school leaders, and researchers we work with in the Algebra Project grapple daily with these dilemmas in a collective quest for more equitable education.

In their 2001 essay, Bob and Charlie asserted that education should be understood as a civil rights issue. Twenty years later, education remains the cornerstone of opportunity and meaningful citizenship in the United States today. Paraphrasing one of Bob’s assessments of the 1960s Civil Rights Movement in Mississippi, he said: We got Jim Crow out of accommodations, we got it out of the vote to some extent, but we did not get it out of education. In the 1980s, Bob founded the Algebra Project in “the Spirit of Ella Baker” and of bottom-up civil rights organizing traditions in the Black community, with its mission to redefine public school K-12 education as an equalizing force in society, particularly by establishing a floor of math literacy that all children can stand upon.

We live in an era where the ability to read, write and reason with the symbol systems of mathematics is essential for full participation in the knowledge-based economy of the 21st Century. And yet, math illiteracy continues to persist as a barrier to full citizenship for far too many young people in the nation. The 2022 National Assessment of Educational Progress (NAEP) report detailed that 68% of 12th-grade students in the country are not proficient in mathematics. And within that figure, 92% of Black students, 89% of Latino/a students, 69% of white students, and 50% of Asian students are not proficient, representing millions of young people in diverse communities all across the United States.

Bob and Charlie’s framing is a testament to the Algebra Project’s belief — shared by many — that quality public education is a right for every student, not a privilege for the few. Theirs is a voice calling for a modern Reconstruction of national values, legislative guarantees, and investment in educational opportunity. Just as the civil rights movement was driven by the voices of African Americans and allies contradicting a systemic and oppressive expectation of silence and compliance, our work today must center on empowering the voices of students, teachers, and communities demanding the education they deserve. The daily struggle for a high-quality public school education is ongoing. We remain steadfast in our commitment to transforming education as an opportunity structure for all. As we seek to move the needle on the key issues of math literacy and school reform, let us heed the lessons of history. Let’s continue to fight for an inclusive, equitable, and quality K-12 public education system for every child, regardless of geography, zip code, or background.

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The dominant proposals for school reform aimed at addressing the plight of poor black children these days — vouchers, busing of black students to white suburbs, magnet schools in inner cities, programs to send Black kids into white private schools—amount to a national program of moving students rather than fixing schools.

The national discussion on school “reform” revolves around designing education as a sorting machine rather than building an opportunity structure. If African Americans are going to make significant progress in education reform, we need to see education and literacy as a civil rights issue. And we need to organize.

Predominantly African-American schools are stigmatized. Providing serious money and resources for most Black schools is seen as throwing good money after bad unless it is for the purpose of attracting white people.
Almost 40 years ago, early in the spring of 1962, seven of us in the Student Nonviolent Coordinating Committee (SNCC) had been arrested for helping escort Black people in Greenwood, mostly marginally literate, about one hundred at a time, to the voter registrar’s office. John Doar was our lawyer and, on the stand as a witness in Judge Clayton’s Federal District Court, I made an appeal on behalf of Black people in the Mississippi Delta for one person one vote. I argued that fairness required that America could not turn its back on the flagrant denial of an entire citizenry’s literacy education and then demand that literacy be a necessary condition for their citizenship. (In this case, their right to vote.)

We won that argument. Black people, in theory, have the right, as citizens, to vote in this country, although as the last presidential election reminded us all too well we do not, when it really counts, have that right as a matter of course in practice.

Black people have also, not yet, won our rights to our literacy education in functional public school systems across the country.

My current work—an effort I have been engaged in for the past twenty years as founder of "The Algebra Project"—links the ongoing struggle by minority people for education and citizenship to an issue of math literacy. We think that in an era where the "knowledge worker" is replacing the industrial worker, math literacy must be added to reading/writing literacy and that illiteracy in math must be considered as unacceptable as illiteracy in reading and writing is now. You cannot boast about being unable to read a book.

The Algebra Project is retooling the organizing tradition of the civil rights movement to advance an American tradition that argues for education as the fundamental structure for opportunity and meaningful citizenship. No one understood this better than freed Negro slaves during and right after the civil war. “The first great mass movement for public education at the expense of the state, in the South, came from Negroes. Public education for all at public expense, was, in the South, a Negro idea,” wrote W.E.B. Dubois in Black Reconstruction.

Their efforts were beaten down and sabotaged after the election of 1876 when, like our current situation, America suffered a tainted presidency, and as of now, the citizenship rights of Black people were the issue. Sharecropping followed the collapse of reconstruction. With this system came presumptions of white blamelessness and of Black intellectual inferiority. “The Negro should be taught to work with his hands,” wrote one writer late in the 19th century. Real schooling, he added, “tends to unbalance [the Negro] mentally.”

Sharecropping was still in place when Fannie Lou Hamer, the resonant voice of the Mississippi Freedom Democratic Party at the National Democratic Convention in 1964 asked the country with her heart, soul, and her two months a year sharecropper schooling, "Is this America?"

There had also arisen in the midst of the Depression the idea of an "aristocracy of the intellect." By the end of World War II, SAT tests and a national selection process that determined who was worthy of the best schools were set in place. This skewed the idea of public education as an opportunity structure—a place where everyone in the democracy was given an equal opportunity to advance—toward the idea of public education as a means of selecting a national elite.

And though we are concerned with math—algebra in particular—it is the Project’s core underlying idea that education in public schools as an opportunity structure for every student that is of relevance to the discussion about educational needs and "school reform” that is taking place today.

In our vision, public education means quality public education for all students. Such an education remains an unfulfilled promise in America. We haven’t put the money or the effort into figuring out what a quality education could be and what students could be expected to learn. As was true of the Southern civil rights movement where sharecroppers, maids, day workers, and others who were expected to be silent found their voice, real change, meaningful school reform will require the voices of students and community demanding the quality education that everybody assumes they can’t handle, don’t want.
(Cont'd from page 1) Destini, currently a senior at Kennesaw State University where she will graduate with a Bachelor’s in Electrical Engineering dreams of working in the power infrastructure industry, using her robust skillset to negotiate the ever-changing utility-development landscape of budget restrictions and regulations. Even her hobbies represent her predisposition for computational thinking: Learning new languages and reading Agatha Christie’s Hercule Poirot series.

Like many students in STEM programs, she wasn't bad at math. But her relationship with it wasn't great either.

“It's just something I have to do. I didn't really give math much thought. It's just something that I have to just push through, especially regarding my major. I just have to hunker down and get through this math stuff.”

When she was in her Sophomore year at Kennesaw, she received an email soliciting applicants for College Math Literacy Workers (CMLWs) for the Algebra Project. She applied, was accepted, and her first introduction to the Five-Step Process began that summer.

Of the Five-Step Process, she recalls, “At first I didn't necessarily understand why we were doing it this way. The shared experience, the drawing, the group discussions. I wasn't necessarily sure why we were doing these things. But when we got towards Feature Talk and Symbolic Representation, it tied it in for me to be like, 'Oh, this is why we're doing it.’ And it was really good just to learn why we were teaching like this, teaching these students not necessarily how to do problems per se or how to compute specific problems, but how to think around those problems and just to understand the whole process.”

During Destini’s summer learning the Five-Step Process, the CMLWs studied the Road Coloring Problem. The Road Coloring module involves a structured diagram of buildings, and roads leaving and entering each one, wherein students are tasked with developing a set of instructions for getting from building to building. For Destini, one of the most interesting aspects was being able to see how her peers conceptualized the problem.

“Seeing other people's cities and designs helped me understand what the Road Coloring process is and why it’s important, specifically how different people’s brains connect to that process and how that can help with other math disciplines.”

She noticed how, as a CMLW tutoring 6th through 8th graders, she could see the conceptual shift in students when they were given latitude to determine their own symbolic representations.

“With that fifth step, I saw that they wanted to represent the math with what they know. So, students will be like, 'Oh, this is the city, but it's built with PS4s and Xboxes. This is a city, but it's made with burgers and fries.' It's very individualized. They make the concept individualized to themselves.”

Destini found herself bringing her unique understanding of the world to the mathematical table. She had a long history with music, and to her, music wasn't too far off from mathematics.

“So in high school, I had been in band for all four years. When I started college, I still played music with my guitar. And I was trying to play with the keyboard. I never took lessons in piano, but I took guitar lessons.

“Whenever we were asked to make this symbolic representation, I was trying to think of a way to make it different because the first thing I was thinking about was a visual representation, but then I realized that there were numbers involved. So, I was thinking about how a scale in music also has numbers if you count the number of notes within the scale. So then I thought maybe I could connect that to the symbolic representation and each building could be like a note or something. And whenever they're leaving, I could just tie it
into the scale system. That's how I got to my symbolic representation.”

Destini imagined the Road Coloring problem as a musical composition played on a piano. Each building in a city corresponded to a note on a musical scale, specifically the C scale. In her city with four buildings, the first building represented the note C, the second building was D, the third was E, and the fourth was F.

Since sheet music for the piano has two sets of lines and symbols, one for the higher notes (treble clef) and one for the lower notes (bass clef), in her city design, the red road represented transitions of notes in the treble clef, and the blue roads represented transitions in the bass clef.

Turning this concept into music, each measure corresponded to a building and its transitions. In her first city plan, all the notes played simultaneously because there was no specific sequence.

The box contains the written instructions for the road coloring sequence. For example, in Building 1, 1 moves to 4 via the red route, and 1 moves to 2 via the blue route, which corresponds to a transition from C to F on the treble clef and a transition from C to D on the bass clef.

“[Visit Algebra.org to hear the composition played]"

Destini’s unique approach surprised everyone in the workshop, including the PD specialist. While she excelled in the Symbolic Representation step, it took a while to get there. As she previously noted, when she first began the Five-Step Process, she didn’t quite grasp what the point of it all was. Despite this, she said it wasn’t difficult to stay engaged.

“The discussions kept me engaged. Particularly just hearing other people’s opinions on what they were doing and what they thought as well, that kept me engaged through the process.”

That ability to empathize with one’s colleagues and peers is an important facet of the Five-Step Process. Being able to understand, or take the necessary time to understand, how another person conceptualizes a problem is as important as one’s own conceptualization. And Destini continues to use that as a tool in her day-to-day life.

“I think that whenever you're doing specific problems or whenever you're focusing on how the problem is done conceptually, it can help you to have this ability to view it from different perspectives. You can connect with others because maybe someone else doesn’t think like me, and someone else might need a wider view of how to do the problem or how to understand what's going on. Not only just helping others with that understanding, but also taking it with you to help with other problems that you encounter, whether that be in work or in school.”
Destini doesn't work as a Math Literacy Worker anymore, but she's noted that her relationship with math has remained forever changed.

“It helps me build on other problems that I can encounter later that I wouldn't have a computer to help me with. I know with things like ChatGPT, you can ask it all these things: What is this, what is that? But it would be to your detriment if you didn't necessarily understand what you're doing, be it with math or with engineering. You have to understand why you're doing it. And I guess with the human conceptualization of math, just understanding why you're doing it and having that toolbox to help you in the future.”

When asked what she would like to impart on students after all she has learned and been through, she is quick to reply, "Just how important imagination and creativity are to math. Most students think of math as either you just have to get it done or they hate math because of how they're taught in school with how strict learning about math is. And if, starting from a young age, we just teach kids that math is fun, math can be fun, math doesn't necessarily just have to be numbers, it could be burgers and fries, it could be Playstations and Xboxes, it could be music, math can be so many different things, and if you just learn that from a young age, I think your mind will shift on what math is. Math doesn't just become math. It's something deeper.”

### Algebra Project Workshop at State of Black Education Conference

Austin, Texas’ Black Leadership Collective invited the Algebra Project and the Young People’s Project to join them at the State of Black Education Conference for an introductory workshop on August, 26th. The Algebra Project had the chance to play the Trip Cards game with students, their families, and community members. The night before, Executive Director Ben Moynihan, PD Specialist Victoria Doctor, and Director of Professional Development Bill Crombie met with local business, community, church, and school district leaders to discuss the state of education inequity nationally.

### Ivan Samstein Joins the Algebra Project Board of Directors

Ivan Samstein has been formally voted in to join our Board. A longtime supporter of the Algebra Project, his father and mother worked on the ground alongside Bob Moses and others in SNCC, and his father worked with the Algebra Project in the early 2000s. The Executive Vice President and Chief Financial Officer of the University of Chicago Medicine, Ivan brings with him a wealth of business and financial development expertise which will be invaluable to the Project as we explore new collaborations, technology, and research initiatives. Of being voted in, he said, “I have witnessed the great work of the Algebra project for roughly two decades, initially informed by my late father’s work with Bob Moses during their time together in SNCC and in later years at the Algebra Project. The mission of the Algebra Project to bring math literacy and educational equity to all is more critical today than ever, and I am honored and thankful for this opportunity to contribute my expertise as I join the Algebra Project's Board and look forward to the work ahead.”
Ember Charter School Collaboration Moves Forward (PHOTOS)

Students of Confluence Academies Experience Trip Line (PHOTOS)

(Photos courtesy of Shahidah Kalam Id-Din)

(Photos courtesy of Greg Budzban)
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