What's Math Got to Do With It?: Bob Moses, Algebra, and the Movement for Civil Rights, January 23, 1935–July 25, 2021

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Introduction

In an address titled, "Algebra, The New Civil Right," presented to the Strengthening Underrepresented Minority Mathematics Achievement Intervention Programs Conference II on November 6, 1993, Bob Moses commented, "I find it ironic that mathematicians should be so centrally placed in a national issue. It seems that history has done you a disservice. It has put to you a task for which you are not prepared. Mathematicians would be the last people that I would turn to to organize the country. And yet, that's what it seems you have to do." The essays that follow are by people who took up his challenge mathematicians, as well as math educators, teachers, and community activists who founded and sustained initiatives that have transformed K-12 mathematics teaching and learning since 1982.

Robert P. "Bob" Moses pushed for mathematics literacy as a civil right for all public school children. He infused this struggle for math literacy with lessons he learned during his pivotal role organizing with Black Mississippians seeking to fulfill their Federal right to vote (1961–1965),

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which interrupted his doctoral studies in Philosophy of Mathematics at Harvard University (1956-1957; 1976-1982). He taught high school mathematics first at the Horace Mann School (1957-1961), then at Samé School for the Ministry of Education in Tanzania (1969-1976), and founded the Algebra Project in 1982. For the rest of his life he engaged with students, teachers, school system administrators, parents, community leaders, university faculty in several disciplines, and national leaders in math education, bringing diverse perspectives together to "raise the floor of math literacy" for America's most vulnerable students. He taught middle and high school classes as a visiting teacher in Jackson, Mississippi (1993-2006), and supported hundreds of math teachers in districts across the nation, always connecting with members of the community, schools, and universities to codevelop demonstrations of effective mathematics learning.

Bob initiated the Algebra Project in 1982 with a fiveyear MacArthur Foundation Fellowship recognizing his work in civil rights, education, and philosophy. He later received honorary degrees from 17 colleges and universities, was Principal Investigator on eight NSF awards totaling over \$11 million dollars, and received support and honors from other foundations and professional organizations, including election to the American Academy of Arts and Sciences in April, 2021.

His book with Charles Cobb, *Radical equations: Civil rights from Mississippi to the Algebra Project* [1], chronicles his civil rights work in the 1960s and how this connected with his development of the Algebra Project. Other writings include a book coedited with Theresa Perry, et al., *Quality Education as a Constitutional Right: Creating a Grassroots Movement to Transform Public Schools* [4]; and a March 2011 article in AMS Notices coauthored with the late Ed Dubinsky, *Philosophy, Math Research, Math Ed Research, K–16 Education, and the Civil Rights Movement: A Synthesis* [3]. Laura Visser-Maessen's 2016 biography *Robert Parris Moses: A Life in Civil Rights and Leadership at the Grassroots* provides a detailed and multifaceted portrait [5].

In a posthumously published opinion article, "Returning to 'Normal' in Education is Not Good Enough," Moses wrote, "In the 1960s, voting was our organizing tool to demolish Jim Crow and achieve political impact. Since then, for me, it has been algebra. What's math got to do with it?—you ask. Everything, I say. Amidst the planetwide transformation we are undergoing, from industrial to information-age economies and culture, math performance has emerged as a critical measure of equal opportunity." [2]

From Bob's address to mathematicians in 1993 to this final opinion article about the importance of mathematics education, he saw an important need for mathematicians to collaborate with others to provide equal opportunity for all.

We believe readers may best explore Moses's legacy through the voices of his collaborators as they share their experiences and perspectives in the pages that follow.

Janet Jemmott Moses

At the end of 1968, Bob and I were employed by the Tanzanian Ministry of Education to teach in Samé Secondary School in rural Tanzania. It was here that we worked and began our family. Bob taught math, and I English. Although the medium of instruction was Kiswahili in elementary schools, English continued to be the medium of instruction in secondary schools, thereby enabling us to teach there.

Samé Secondary, snuggled in the plains of the Upare mountains, 65 miles south of the majestic and daunting Mount Kilimanjaro and 300 miles north of Dar es Salaam, the unofficial capital of Tanzania and the home of Kiswahili culture that connects the East African coast and the southern swath of India, was a boys boarding school. In response to British colonial education which left the new country with 16 college graduates, and an elementary school system which only could accommodate 13% of its elementary students, the Ministry of Education faced the daunting task of building a system of free, universal education, and of creating a pipeline of Tanzanian teachers.

Armed with Willard Van Orman Quine's assertion that the language of mathematics gets off the ground on the regimentation of ordinary discourse, Bob set himself on a journey to become fluent in the ordinary discourse of Kiswahili. He remarked that Kiswahili brought a clarity to the operation of 3×2 that was absent in English. The verbatim translation of the expression 3×2 in Kiswahili (tatu mara mbili) reads 3 two times. This expression in English reads 2 three times. I think that this insight provided a conceptual basis for what later became the Algebra Project's first curricular module, with the experiential event that requires students to answer "how much" and "which way" queries embedded in the number line.

In Tanzania we experienced an educational system that out of necessity was created to harness the intellectual and creative talents of its children. This necessity infuses the values of the Algebra Project, which measures its success against a goal post of creating a pipeline of math literate students prepared to engage the economic requirements of first-class citizenship in the 21st century.

Bob loved math. And his standards for his students were as rigorous as the standards of mastery to which he

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held himself accountable. He believed that these standards were the floor of an earned insurgency by students who had been abandoned at the bottom of the well of academic achievement, and that relief of their condition was to be found in the classroom and in the organizing efforts for a quality education in their communities.

David J. Dennis Sr.

I do believe that my relationship with Bob, one of the greatest human beings I have ever met, was destined. I first met Bob in Baton Rouge in 1962. He was heading a project for the Student Nonviolent Coordinating Committee (SNCC) in McComb, MS, and I was heading a project for the Congress of Racial Equality (CORE) in Baton Rouge, LA. Bob and a group of SNCC workers came to Baton Rouge to recruit some of the students from Southern University who had been suspended for participating in demonstrations in downtown Baton Rouge to work with them in McComb. That was my first meeting and it was at a time when I was at a crossroads as to what we should be doing. Bob shared with me his ideas and future plans for Mississippi, which later resulted in me asking CORE to transfer me to Mississippi, which they did in April of 1962. I remained in Mississippi with Bob until we both left in 1965.

After 1965, I did not see Bob again until 1989, when Mississippi veterans of the Civil Rights Movement met in Jackson to protest the movie "Mississippi Burning" which we believed was an inaccurate story of the realities of Mississippi at that time. At the same time, I was undergoing serious psychological issues that were related to my past work in the Civil Rights movement. I was at a loss as to what I should be doing with my life.

During our four days in Jackson, Bob introduced me to the Algebra Project. Bob and the Algebra Project probably saved my life. Bob had to sense my need and he did not let go until I joined him in 1992, promising him three years of my life with the Algebra Project. I am still here. (David Dennis Sr. has been the leader of organizing the Southern Initiative Algebra Project since 1992, assisting the project's introduction into rural and urban settings of several Southern states including Mississippi and also developing partnerships with several historically Black colleges and universities (HBCUs) including Xavier, Dillard, Virginia State University, and the University of the District of Columbia.)

During my 30 years with the Algebra Project, Bob and I grew closer and our families bonded. We could sense when one needed the other's touch, smile, and soothing words. He will forever live as long as I live.

I love and miss my Brother.

Lynne Godfrey

I first met Bob in the early 1980s when he and his wife, Dr. Janet Moses, enrolled their children at the Dr. Martin Luther King, Jr. Open School (King Open) in Cambridge, Massachusetts, a school organized around principles of equity and social justice. When Bob's oldest daughter, Maisha, was a student in my 5–6th grade classroom, Bob began working with the school to take a closer look at our math data, which shed a harsh light on the school's practices of tracking and discovered that this was creating segregated math paths. This practice led to disparities in access to conceptually challenging and rigorous math for Black, Latinx, and economically under-resourced students. This was the beginning of a lifelong commitment to learning and activism for myself and many of my colleagues at the King Open School.

For two years, I apprenticed with and observed Bob's unwavering attention to children's thinking and the nurturing of their mathematical ideas and identities. Materials for the Algebra Project's first instructional materials grew out of the work Bob did in the classroom. Bob was as patient and committed to the adults' learning as he was to the children's, often meeting with teachers on weekends and hosting evening sessions for parents and caregivers. He dedicated his time to instilling a deeper understanding of the mathematics and the sociopolitical implications of math that serve as its gatekeeper. Bob's message of math as a civil right has been the organizing force for many educators, young people, and their families. His commitment to a quality math education exemplifies the "NCTM Principles to Actions" [13], ensuring mathematical success for all.

Charles Payne

It is hard for me to think about Bob Moses without smiling. He was one complicated man. I thought of him as something of an older brother, beloved and respected but annoying because he was right too often.

I first met the Moses family in the late 1970s, when I had recently started teaching a course on the Civil Rights Movement. Bob agreed to speak with my class, but only if he could bring his whole family. I spent as much time watching the family interact with one another as I did talking with Bob and Janet about the movement. It was very clear that doing family was, for them, doing the movement.

You could see movement values in the way they talked to each other and to the children. I think that was a major

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part of what a great many people got from being around Bob and Janet, a sense that the movement wasn't something over yonder and back then. It was something that was wherever you were, if you insisted on standing on movement values.

Years later, I found myself in Chicago, helping to establish the Algebra Project there. Two things stand out about the early days of the work. I got to watch Bob and Bill Crombie teach a lesson to parents in a community room in the justly infamous Robert Taylor Homes. Parents needed to appreciate what their children would be experiencing. The lesson started with a chart representing the Red Line, the train line serving Robert Taylor Homes, something the residents knew more about than Bob and Bill did. The graph of the train line became, as discussion went on, a number line, and talking about changing direction on the number line became a discussion of positive and negative numbers, so people found themselves talking about a key algebraic concept in ways that were rooted in experiences they owned.

People can learn things that are thought to be beyond them if you start by respecting what they know and do. The first schools were scattered across the city, but kids at different schools started carrying their books so that the Algebra Project materials were on the outside where they could be seen. They knew perfectly well that they weren't the kinds of kids who were expected to learn tough subjects like algebra, and they were announcing to the world that it had underestimated them.

Being in the Algebra Project amounted to what Theresa Perry (professor emerita of Africana Studies and Education at Simmons University) would call a counter-narrative. In my own teaching now, I am acutely aware that getting the technical aspects of teaching right is often going to be less important than giving young people tools to fight the labels imposed on them. The Algebra Project got both right.

Alan Shaw

In the Spring of 1984, while I was the president of the Black Student Association at Harvard University, Bob Moses was our authentic example of a compassionate, courageous, and conscientious Black intellectual. Bob's compassion, especially for those steeped in deep poverty and equally deep oppressive political and institutional systems, led him into the Deep South in the early 1960s. Bob spoke to us about his work in the Student Nonviolent Coordinating Committee (SNCC) and Council of Federated Organizations (COFO), and about Freedom Summer and the Mississippi Freedom Democratic Party (MFDP). We learned of his courage as he saw friends die, and as he himself was beaten and shot and faced constant death threats for efforts to register Black people to vote in a country that is supposedly one of the world's great authentic democracies.

And we were profoundly challenged by his conscientious admonition that those of us with economic, cultural, or political capital should work to build up and empower those who are less fortunate. He explained that he would not be empowering Black sharecroppers in Mississippi if they were dependent on some Harvard educated northerner to lead their political movement. If, on the other hand, in the ethos of a community organizer, he helped to support local leadership, like that of Fannie Lou Hamer in the Mississippi Freedom Democratic Party, then he was truly empowering Black sharecroppers. When Bob finished his talk in the spring of 1984, we were in awe.

Yet, it was not just the work that he had done in the past that was so inspiring. Bob's work at the time was a new twist on a new type of community organizing, but this time it was inside of the schools. He challenged us, as college students, to join this work of empowerment that focused specifically on our children, but also indirectly on the adults willing to come together and form an empowering communal context to support our children. We spent many hours in classrooms at the King Open School as the first of what Bob would later call College Math Literacy Workers (CMLWs). We also spent countless hours in his living room and the living rooms of other fellow organizers as he did the intellectual work of developing the Algebra Project pedagogy on numerous flipcharts, and as he constructed the "five-step" curricular process itself, that is still central to the Algebra Project curricular process to this day.

Bob was not just bringing a new way of thinking into an elementary school, Bob was bringing a new way of thinking onto a college campus, and it transformed us. One of the fondest memories I have of him is when he heard that I was an amateur gymnast, and he urged me to do a backflip in the cafeteria for the kids at the King Open School, so the kids could use that as a shared event to study how math is involved in everything we do. I did as I was told, and afterward that afternoon we talked with the kids about the conservation of angular momentum and the significance of what happens when the one doing the backflip pulls into a tight tuck. But more than that, because of Bob, Michelle and I got connected to a community of young people that afternoon, who saw how engaging and fun experiential mathematics could be. Our community is in desperate need of more leaders like Bob Moses. He may no longer be with us, but his spirit and his shining light leading the way forward, lives on.

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Nell Cobb

I came to the Algebra Project in Chicago in the early 1990s as a veteran secondary mathematics teacher in the Chicago Public Schools. I thought that I was a good mathematics teacher, one who reached students by helping them understand what I was trying to teach from the mathematics textbook.

I really never thought about why the material was organized in a particular way or really how I could teach other than to show students how to solve the problem, do several examples with them, and then have students practice the process, known as the "gradual release strategy."

Here is how the students who have experienced the Algebra Project Trip Line unit would approach a task that asks them to find a solution to the equation 2x + 5 = 11. We would interpret the equation in terms of the context of movement on the number line. We start at location 2x, move 5 units to the right and end at location 11. On the trip line, it looks like Figure 1.



A person can provide a context for this problem in ordinary language as "Mary went on a run starting at 2x Street which is twice the distance from the center of the city (the origin) as x Street."

"She runs 5 units to the right and finishes at 11th Street. What is the street name for 2x Street? What is the street name for x Street?" A picture could look like the one shown in Figure 1.

From 11th Street if we move 5 units left to determine 2x street, we would be at location 6th Street. Since 6th Street is twice the distance from the city center as *x* street, we find that *x* has to be 3rd street. Which can be interpreted as in Figure 2.



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This is an interpretation of the abstract representation, 2x + 5 = 11, that helps students understand mathematics within a certain context as a result of a shared experience.

During my career I had the privilege to work with college students in mathematics who were placed in remedial classes as well as with preservice secondary and elementary teachers. My teaching changed when I realized that in the Algebra Project one of the first goals was to teach by helping people make sense of the mathematics they study. I had no idea what that meant until I was able to observe Bob work with our Algebra Project Teachers in Chicago. Now this is ingrained in my brain, and I find ways to help people make sense of mathematics and to be open minded about learning in general.

Florence Fasanelli

In 1988, Dr. Arnold Strassenburg, Division Director of Teacher Enhancement Programs at the National Science Foundation (and my boss at the time), introduced me to Bob with the goal of exploring whether NSF could fund the nascent Algebra Project. This was not possible at that time, as education was only beginning to gain strength at NSF. However, I then introduced Bob to Dr. Dorothy Strong, Director of Mathematics for Chicago Public Schools. By 1990, with Dorothy's support, the Algebra Project was underway in Chicago schools and Bob's work became a larger part of the broader mathematics education community.

Bob's methods were new to me, but after 1992, when I took a job at the Mathematical Association of America (MAA) designing and directing the Strengthening Underrepresented Minorities in Mathematics (SUMMA) Intervention Program, I experienced the depth of the connection to the Civil Rights Movement. In March 1993, while making a site visit to mathematician Charles Alexander's project at the University of Mississippi, we visited the Delta Algebra Project in Greenwood, MS. Middle school students hung posters they had made to demonstrate the commutative property by walking back and forth in the neighborhood. We then rode a bus through Greenwood with the students and learned about the Freedom Riders.

I accepted Bob's invitation to drive me to Jackson to spend the night with his friend, Dave Dennis, the lawyer who directed the Algebra Project initiative in the Mississippi Delta. For the entire drive Bob spoke about his training at Harvard in philosophy and how his professor Willard Van Orman Quine had impressed him with the concept of "regimentation of ordinary discourse." Quine's position that the language we use in mathematics is not a natural language came to underscore Bob's approach to

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learning and teaching mathematics. At meetings in later years, Quine's book was often held in Bob's hand. Listening and learning from discussions with Bob changed my approach to teaching teachers and helping others develop projects for funding with the fundamental idea that quality education is a civil right—as is voting.

Luckily, Bob accepted invitations from the SUMMA Intervention Program to bring his methods to a larger group of mathematicians and mathematics educators. In October 1993, Bob outlined his thinking with his usual elegance for the SUMMAC (Consortium) of 90 mathematicians who conducted out-of-school programs for minority students on their campuses. He compared the struggle for literacy and voting as the way to political power with the struggle for mathematical education as the way to economic power. He made it clear that if these listening educators were to be successful, they must organize their communities to assist in bringing the empowerment of mathematics to all. In the lively follow-up, Bob discussed deep issues of philosophy and the epistemology of mathematics contrasting the Frege-Quine position of mathematical existence with Hilbert-Church's mere consistency of mathematical objects. As one mathematician later reflected: for intervention projects and university enrichment programs to succeed, the leaders must speak the students' language, and then broaden their experience to the power of the generality of mathematics. After this powerful talk, a member of the Mathematical Sciences Education Board commented: "Now I know what it is we have been trying to do."

Uri Treisman wanted to meet Bob to be able to link his work with the Dana Foundation to Bob's work. We met in Cambridge on May 18, 1994 where Uri expressed the Foundation's concern about what might be useful to American education with innovations that touch on social justice. These two MacArthur Fellows sought to share and support each other's way of thinking about leadership and the foundations of their approaches to learning mathematics. By that time, the Algebra Project was in 110 schools in seven additional states forcing the questions: "What are the values that would underlie a national project, since the Algebra Project is a grassroots structure?"; "How do you have a curriculum that is alive and meets the needs of the customized local version?"; "How do you take on the history and politics of the school system as we use local materials and hook up with local groups?" Several hours later there was enough material to propose a planning conference for expansion across multiple sites.

My own teaching changed. I learned new techniques and shared them with my graduate students at George Washington University, who then used the techniques and shared them with others. While not officially part of the Algebra Project, all of the people using his techniques have assisted in raising the floor for the bottom quartile through Bob.

John Belcher

"Students spend much of their time in mathematics class trying to figure out what the teacher is thinking and very little time on their own thinking." Bob spoke words to this effect early on in my tenure with the Algebra Project. My mathematics education journey up to that point had been circuitous. I graduated from Brown University with a ScB degree in Applied Mathematics. I had come to jokingly say that I applied the mathematics of this degree by being a drummer and studying West African drumming traditions.

It took some years for me to recognize the profoundness of this observation. I have witnessed how students become laser focused on cues from the teacher. Comments such as, "great question" or "wonderful answer" provide insights into what the teacher is looking for—what the teacher is thinking. It contributes to the phenomenon of how, typically, one category of questions dominates students' participation in conventional mathematics classes—variations of the question, "Am I right?" (e.g., "Am I doing this right? Is this the right answer?") These manners of privileging the teacher as authority have the unfortunate consequence of disconnecting students from their own thinking to an extent that is not the case in other subject matter classes.

Bob's focus was upon ensuring that all students, particularly students of color given their histories of denied access, achieve a "floor" of mathematics literacy—an acceptable standard of competency defined by local communities. In [1], Bob cites Ella Baker in providing a frame for understanding "radical" in the context of the Algebra Project's work: "It means facing a system that does not lend itself to your needs and devising means by which you change that system." The operative words are "your" and "you," in that the "target population" must operate with agency—in the case of the Algebra Project's work, young people of color (and their families and communities) need to make the demand for mathematical literacy and act on those demands in order for the work to be considered successful or radical.

Bob possessed the power of imagination, heightened by his ability to compel others to imagine along with him. Just imagine transformative possibilities that might emerge from investigating mathematics in environments that feel like "home," in the sense that discourse and other cultural patterns feel familiar and that one's "whole self" feels welcome. Just imagine producing new, fieldexpansive mathematics knowledge based upon the ways

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that time, space, pattern, and arrangement are explored and manipulated within African, African-American, and other African Diasporic cultural traditions. Just imagine "a federal civil rights bill for education, akin to the Civil Rights Act of 1957" [2] asserting the constitutional right to a quality education for all Americans. Just imagine...

Frank E. Davis and Mary M. West

For the past thirty years, we have had the privilege of conducting research and evaluation on the Algebra Project, usually through grants from the NSF. Although we have heard Moses say "I really don't know what researchers do" with a mischievous look in his eye, his belief in the importance of research and evaluation as a tool for social change was unquestionable. Moses's contribution to this work was always visible and substantial, and his innovations were in the forefront of major national shifts in research and evaluation of mathematics education.

For example, his doctoral studies focused on philosophers who sought to develop theories of knowledge as aspects of both individual and collective social experiences. He was drawn to the work of Willard van Orman Quine, who saw the work of science as the development from ordinary language to a more restricted language that provides a clarity and simplicity of theory and supporting evidence. Moses linked this study to his experiences as a mathematics teacher and students' difficulties learning mathematics, resulting in a pedagogical process called the "five-step" curricular process.

This process was grounded in experiential learning and described several steps for facilitating students' reconstruction (and construction) of a new language out of their ordinary language. "People talk" was regimented to create "feature talk"—a language of key concepts and symbolic representations developed in the science and mathematics communities of practice. The important first step was engaging in a shared experience that was designed to gain students' attention and motivate their examination of how we represent objects in pictorial, linguistic, and symbolic forms. This process provided a coherent approach to considering questions about what to teach, how to teach, and what and how to assess in their learning.

Bob's vision of the work needed to demonstrate this approach led to several major research and evaluation projects, some still continuing. In our studies of interventions in schools we found the Algebra Project was successful when implemented with support of the school and district leadership, teachers, and community members. With classroom support from the Algebra Project's professional development specialists for a few years, parents' buy-in, time for teachers to plan together, and ideally with support from local university faculty, students and teachers thrived. Each site was different, so these interventions required work sensitive to local communities and state requirements. But students of middle and high school teachers using project classroom materials and pedagogy who had this support, advanced though Algebra and higher math courses and to high school graduation at higher rates than groups of similar non-Algebra Project students in the same schools or districts.

Research is also continuing in areas of the development of learning progressions and trajectories and more precise understandings of how students develop mathematics concepts such as functions, the development of students' identities as mathematics learners, and the use of technology in mathematics learning, for example in computational thinking, modeling, and assessments. Another significant contribution of Moses's was how to propel work on a social problem and agenda that is embedded in the complex social structures of our society. Moses saw a "problem space" requiring a "solution space" that linked together those who lived the problem, who have the necessary insights into its solution and who must participate in its solution (for example, students and teachers in local school communities) with allies who have the necessary expertise and potential to reshape the system of education, to produce a shared vision and collaborations to achieve solutions that propel change.

Bob saw his work as guided by the purpose of creating learning opportunities for students who have been denied the opportunity to achieve the mathematics literacy necessary for 21st century economic and civic participation. Research that is both fundamental and use-inspired is said to be in "Pasteur's Quadrant" [15]. Pasteur provided us with fundamental knowledge about the origins of human diseases as well as possible treatments, in the service of public health. We think that maybe Moses's poignant question about "what researchers do" may be linked to his foregrounding the goal of solving a fundamental and use inspired problem of achieving a quality mathematics education for all.

Over the years, Moses brought researchers together with many others who were working to overcome educational inequity linked to race, ethnicity, and class. In these settings, all of us were required to broaden our professional and personal frameworks on the problem to include many more actors and collaborators. His question "what do researchers do," while not simply answered, has led to critical and fundamental research that informs a civic goal of equitable educational opportunities.

Jay Gillen

Bob said "It wasn't radical to do voter registration per se in the 1960s. What was radical was to insist that sharecroppers in Mississippi had the right to vote. Today, it isn't radical to teach algebra in schools. What is radical is to teach algebra to the students that the country has decided to throw away."

I want to explain one of the contexts for this statement that I think Bob had in mind and that might not be obvious.

I remember Bob saying that in a certain way the Klan had won, because in the past they were an external force that could be identified and fought, but now they are inside of people's heads—though we deny it–and so they are harder to identify and harder to confront.

No matter our race or ethnicity, we need to understand the structural obstacles within our own heads. Bob wants us to think about how radical it is to see all Black children as mathematicians. How radical it is to see all Native children as mathematicians. All immigrant children and children of immigrants as mathematicians. It would not have been radical to demand the vote only for a few sharecroppers. It is not radical or even decent to "rescue" a talented tenth from poverty or to extract some bright children from the humiliating circumstances of the schools that we condemn millions to attend.

The unique circumstances of the information age expand the requirements for full citizenship. Each person must be imagined today as capable of doing sophisticated, college-level math, because political and economic power in the 21st century hinges on the ability to make decisions with data, about technology, about systems represented quantitatively and symbolically.

Failing to democratize the vast power of science and math will continue to result in the hardening of caste and will leave a whole segment of the population in near servitude, just as millions are locked today in a caste status defined literally by the iron bars of prisons and by the intricate mazes of punitive state monitoring and supervision. Bob used to say that we have only a short time before the transition to the information age is complete and the window of opportunity for radical educational change has frozen shut.

But what does it mean to call this a problem of imagination? And why is it so hard for us to notice the Klansmen running around in our thoughts? Can we rid ourselves of the voices in our heads that say it's impossible?

In Mississippi pre-1960, there was a failure of imagination to understand sharecroppers and day laborers as citizens, or we should say, White people imagined the possibility and it scared them so much that they did whatever they could to make that thought taboo. The strategic strength of the Student Nonviolent Coordinating Committee (SNCC) was to work from the inside out, to provoke changes within the minds of both the oppressor and the oppressed so that new possibilities for active growth could become apparent. Still, very few of us today—of any complexion—imagine that the typical African American student is a strong mathematician. Do we celebrate "exceptions?" Of course. But do we assume strong, fluent, creative math ability as normal? Certainly not. That's a failure of our imaginations.

Bob Moses said that doing math with young people the country writes off will make all the difference in securing a democratic future for America. He believes this because he visualizes tens of thousands of teenagers passionate about sophisticated mathematics, organizing around police killings, immigration, the environment, but also around math, demanding that they and all their peers be fully included in the information age. He calls this "an earned insurgency." Doing math as intentional collectives in neglected schools earns the attention of the country. Organized, politicized teenagers who are not only learning, but *teaching* math can pry open the imagination of the country the way young Black leaders organizing sharecroppers to vote in the 1960s pried open the country's closed, hooded eyes. As Bob repeated again and again, "If we can do it, then we should."

Greg Budzban

"What are you working on?"

The question came from Bob Moses. As the department colloquium coordinator for Southern Illinois University, Carbondale, I had invited Moses to campus in April 2001. He had recently published [1], describing his founding of the Algebra Project and its connection to his historic voter registration work in Mississippi. The Algebra Project is dedicated to a national mathematics literacy effort so that underserved minority students can gain the skills necessary to succeed in today's increasingly technological society. He posed the question over coffee after stopping for lunch on the way to the airport after his visit.

I grabbed a pen and some napkins and began to describe the Road Coloring Problem (RCP).

The RCP first appeared in published form in a 1977 paper of Adler, Goodwyn, and Weiss [9]). Suppose one is given a directed graph and, for simplicity, that each vertex has outdegree two. A *road-coloring* is a one-to-one assignment of two labels (red and blue, or r and b) to the edges leaving a vertex. Once a graph is labeled, any finite

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sequence of labels is an *instruction* and a transformation on the set of vertices of the graph. The RCP focused on identifying the properties of the directed graph that ensured one of the colorings would have a *synchronizing instruction* mapping all vertices to a single vertex. At that time, the problem was still unsolved. It has since been solved by Avraham Trahtman [8].

Moses listened intently and asked if he could take the napkins with him. I dropped him off at the airport and told him what an honor it was to have met him. Two weeks later, I received a message saying he wanted to talk about the RCP and an NSF proposal. When I called, he explained that he had shown his students at Lanier High School in Jackson, Mississippi the RCP and challenged them to find synchronizing instructions. His students began to construct "cities" and search out the different ways to color the roads. They loved "solving the puzzle" and were fascinated by the unsolved nature of the problem. He wanted to know if I had ever considered what high school-level mathematics could be extracted from what he called the "experience."

I was intrigued and drove to Jackson to see for myself. The students at Lanier are almost exclusively African-American. Each morning they walked through metal detectors in front of uniformed police to enter school. It was the middle of May when I visited, and the summer heat was oppressive. Air-conditioning vents leaked water into rusted trash cans in the hallways. Bob met me and said that he was going to bring his 9th grade students to the library. More than a hundred students came and sat in groups at tables. I watched as they laid large sheets of paper on the tables and placed poker chips on each of the vertices. Spontaneously, a student at a table would say something like, "Try this..." and then say an instruction, "red-red-blue." As I listened, I heard ideas emerge. They spoke of the "buildings" they were "leaving from" and the buildings they were "going to." They almost always moved the pieces at the same time, coordinating their actions with their fellow tablemates. I realized what Bob meant by an "experience." The students were having a physical experience of functions and their compositions.

I noticed that some of the graphs had the property that each vertex also had indegree two. These structures permitted a road-coloring in which both r and b were permutations. Such a coloring would never produce a synchronizing instruction. I listened as they struggled with this problem and finally had an idea of what to discuss with them. I went to the front of the library, asked them to stop what they were doing, and on the left side of a sheet of chart paper drew a graph having a road-coloring of two permutations. Next to this I took the same graph and road-colored it in a way that would produce a synchronizing instruction



Figure 3. No synchronizing instruction exists on the left. On the right, for example, *rb* is synchronizing.

(See Figure 3). I asked the students if they could see and explain the difference in the two road-colorings.

A young man near the front raised his hand. "You could never solve the puzzle with the one on the left," he said confidently. "Why not?" I asked. "Each person goes to a separate building. You never have two people going to the same building, so you'll never be able to get everyone together."

Bob stepped forward and asked the student to turn around to the class and repeat what he had said. I later learned how important it was to Bob to nurture students' ability to articulate their ideas to a group. The student repeated what he had said, and I saw many students nodding their heads.

My life was transformed at that exact moment, and over the next 20 years I worked with Bob Moses and colleagues at the Algebra Project to build curricula based on mathematically rich experiences making important ideas accessible for wide ranges of educational backgrounds. I learned so much from him as a mentor. We have used road-coloring with students as young as 3rd grade, but there are still research-level problems within the experience. For Bob, it was critical to find ways to engage students with **real mathematics**. As he said, "What's math got to do with it?—you ask. Everything, I say."

Joan Wynne

Some might say Bob Moses was a "Renaissance Man." He was a mathematician, but also a philosopher who studied Camus, Sartre, and Fanon. He loved music, the arts, and literature. As a radical thinker, Bob intuited that Black liberation, ultimately, would be the way to extricate the grassroots from elitist clutches on those domains and from the perils of second-class citizenship.

Because I embraced literature and social justice, I came to Bob's work not as a lover of math, but as a devotee of his courageous history in the Civil Rights Movement. Little did I know, then, that I would learn and profess later, that math literacy, in the 21st century, is essential to our children's economic, legal, and civic survival.



Figure 4. From left to right: Melvin Weaver, Greg Budzban, Maisha Moses, and Demetrica Gorden at a Professional Development session for teachers on the Road Coloring Curriculum.

My conversion began while watching Bob, who often stayed in our home, prepare math lessons for teaching in Miami classrooms. He used student reflections on that day's chart paper to probe how to design new lessons for the next day's instruction. I marveled at his precise attention to every detail of students' conceptual conjuring. And watched as he used the same care to devise metaphors for teachers that might inspire them to dig deeper into the granular and the gestalt of mathematics.

Sometimes, as Bob listened to jazz late in the night, he wrote articles using the cadences, and often the lyrics, to explicate a new policy direction for the nation's Congress; or the consequences of ignoring America's caste system that denies disenfranchised children equitable structured opportunities for education; or professors' need to invest time in K–12 classrooms.

During Bob's seventeen-year partnership with Florida International University, he often pondered renowned authors' works, especially James Baldwin's, later writing essays where he used authors' words to explain the gravity of the nation's obligation to right the wrongs of its history, especially in education. These deliberations grounded me in a slice of a new Civil Rights Movement, the demand to make math literacy a 21st-century constitutional right.

I share some of Baldwin's words that capture Bob's work as a mathematician and as a freedom fighter. In 1964, serendipitously, while Bob was organizing Freedom Summer in Mississippi, to shine the light on the horrors of the killing of "Black Mother's Sons," Baldwin was writing these words:

One discovers the light in the darkness, that is what darkness is for; but everything in our lives depends on how we bear the light. It is necessary, while in darkness, to know that there is a light somewhere, to know that in oneself, waiting to be found, there is a light. [11] Bob Moses refused to let the light go out for the nation's children. With a dolphin's grace, he swam into the depths of the darkness, danger, and meanness that surround our children. With generosity and humility, he brought the light—the moral and intellectual light, the light of justice, courage, and liberation to everyone he touched; every community he entered; the youth he deeply listened to and nurtured; the teachers he guided to pursue excellence; the scholars he inspired to take their talents to schools and communities; the institutions he challenged to dismantle the oppressive structures that strangle our youth; the American Congress he chided for deliberately denying quality education to African American children; to every crawl space that he dared to refuse him entry, he brought the light.

And now Bob Moses expects us all to carry that light forward, whether mathematicians, artists, nation builders, youth, or elders. Like Baldwin, Bob expects us to never break faith with one another, so the light does not go out, because we are responsible to the generations yet to be born. Bob's life echoed Baldwin's words: "The light, the light, one will perish without the light."

Bob showed us all, even Baldwin, "how one bears the light."

Marta Civil

I think I met Bob for the first time in November 2004, at a conference on Culturally Responsive Mathematics Education at what was then the NSF headquarters in Arlington, VA. I knew of Bob's work in very general terms. For example, quite a few years earlier, I remember being in Boston and talking to a friend and colleague about Bob's idea of using the T in Boston (the subway) to engage students with positive and negative numbers based on their lived experience with the transportation system. While I was not very sure about the details, the message to me was clear: students have lots of everyday experiences that can serve as grounds for mathematical explorations. This approach resonated with my own work in the Funds of Knowledge for Teaching project in Tucson: students have rich mathematical experiences that often go unnoticed because they do not match those provided in school curricula. Bob's work in the Algebra Project aimed to change this situation.

At the conference, Bob engaged us in a mathematical exploration. I think it had to do with how to make sense of "a-b = a+(-b)" [6]. I remember getting caught into a mathematical/philosophical conversation with one of my group members as we worked on this activity, but to be

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honest, I also remember wondering "what does this have to do with culturally responsive mathematics education?" Yet I also remember Bob's genuine interest in all the participants' contributions. Here was this well-known civil rights activist and mathematician, someone that many of us had heard about but had not met till then, spending his time with us, listening to our ideas in his characteristic humble and kind way. To me the lasting impact of Bob's legacy is his kindness and his interest and respect for others' ideas while always moving forward towards dismantling social injustices. The way he interacted with others is an example of culturally responsive mathematics education—I see it now!

Bob Megginson

I first heard Bob Moses speak in the 1990's at a mathematics conference and later at a session for another mathematics conference. In the second conference, Moses spoke about mathematics education as a civil right, and how the importance of that came through loud and clear in something he had read in that morning's newspaper (which he brought with him, and waved over his head as he spoke). The talk was terrific, and it was immediately after that session that I first actually met him.

Some years later, while I was serving a term as deputy director of the Mathematical Sciences Research Institute in 2002–2004, the Institute established an Educational Advisory Committee. To our delight, Bob agreed to serve on the committee, and was a frequent and active participant in the resulting MSRI Critical Issues in Mathematics Education workshops.

Bob's influence did not end with mathematicians but also expanded to politicians. Congressman Jamie Raskin (D, Maryland) described how Bob's organizing methods inspired his own in his first run for public office, in a primary campaign for the Maryland State Senate, saying

"But how could we compete against a long-term incumbent backed by machine politics, big money, and major organizational endowments?...

"I had this deep instinct because of a book written by my hero Bob Moses, the philosopher-activist who helped turn the Student Nonviolent Coordinating Committee in the 1960s into an historic force for sweeping change in Mississippi and throughout the South...

"In his book *Radical equations* (coauthored with Charles Cobb [1]), Moses asks the question 'How do you organize?' His answer is: you bounce a ball.

"You bounce a ball, and some little kids come by to play, and then some bigger kids arrive, and then some high

Bob Megginson is an Arthur F. Thurnau Professor of Mathematics at the University of Michigan.

school and college kids, and you begin to talk issues with their parents, and then you organize.

"Bob's bouncing ball and remarkable human-scale organizing led to Freedom Summer; the Mississippi Freedom Democratic Party; the great challenge to Dixiecrat politics at the 1964 Democratic National Convention in Atlantic City, New Jersey; the Civil Rights Act of 1964; the Voting Rights Act of 1965; and the transformation of the Democratic Party....

"In our campaign, I told Tommy (Raskin's son), we already had lots of adult volunteers, but we needed to recruit young people, too.

"We needed to bounce a ball." [10]

Raskin then named his campaign Democracy Summer, and the ball that Bob metaphorically handed him took quite a bounce, since Raskin, against expectations, won that primary and then prevailed in the subsequent election.

Just yesterday, I spoke at the University of Michigan's Honors Convocation, which this year had the theme "ethical leadership." It seemed fitting that I should end my talk with some remarks about my own personal hero:

"We lost an icon of ethical leadership when the great Civil Rights leader Bob Moses passed away last July. I learned a lot about ethical leadership from him, particularly when it seemed like nothing I was doing was making a difference. After all the beating, intimidation, and violence he faced during the Civil Rights Movement of the 1960s, it might seem that he would have every right to throw up his hands and say he'd done enough. But when people would express discouragement despite working hard at what they knew was right, his quiet response would be something like, 'Don't ever think that what we do isn't making a difference. It does.' And then people would go out and keep on making that difference."

I miss him very much, and will always cherish the difference he made for me.

Deborah Loewenberg Ball

In Jewish tradition, when one speaks of a person who has passed, it is customary to say after their name, *zichrono livrachah*. Translated, it means, "May the person's memory be for a blessing." I am always struck by the unusual grammar of the phrase "for a blessing." The grammar implies an important question. What does it mean for a person's memory to be *for* a blessing?

From the first time I met Bob Moses, I felt his essence as a teacher. He was striking in his capacity to use at one moment, language and speech, and at another, silence, to

Deborah Loewenberg Ball is a William H. Payne Collegiate Professor of Education at the University of Michigan. focus others on an essential point. He was deliberate and intentional. He was a teacher who focused not on being the star, or the entertainer, or the director, but on building in others the necessary commitment, focus, desire, and the capacity to push, to insist, and to not settle.

One such moment of seeing him in action as the teacher he was took place about 20 years ago in a large rustic open building, deep in the trees, at the Asilomar Conference Center south of California's Bay Area, not far from the Pacific Ocean. After supper, as the light faded, Bob had been invited to gather participants who had come together in their commitment to work for equity in mathematics education. He had been asked by the organizers to frame the issues and the work ahead. I remember sitting on wooden chairs, while Bob was sitting, facing us, deeply quiet. When he spoke, he talked about the urgency of raising the floor to put a stop to the way the system fails young people—Black and Brown, poor—and denies them mathematics education. The quiet of his voice only put more power behind his message. The silences required us to think, to take into ourselves and contemplate what he was saying.

Another such moment was when Bob was the commencement speaker and honorary degree recipient at the University of Michigan. One evening while he was in Ann Arbor for this event, I hosted a dinner for the wide range of people who sought to hear and learn from Bob. The large open space that is our main room and the adjoining kitchen and open dining room were packed with people, sitting on the floor with plates of food, standing against walls, perching in pairs or threes on chairs and stools. Bob himself sat on a stool and narrated the trajectory of his work as an organizer and fighter for civil rights, from voting rights to mathematics. He held the room. I have never felt the thickness of human intent listening in quite the same way. The next day, his commencement speech before several thousand people, was just one sentence. It stunned the university president. Commencement speeches are often too long, and sometimes trite. His was neither. He said that his purpose was that we remember what he said, this single imperative: "I want everyone here to accept as a common mission to guarantee quality public education to everyone in America as a matter of right guaranteed by the federal constitution." In its unadorned power, this single point was what he sought to impress upon every person in that hall that day.

Once again, I saw the power in Bob's deliberateness. He carried that urgent message in different forms to different groups. I saw him actively recruit others who could contribute their power, their work, their muscle, and their commitment, to this fundamental purpose. For him, the work was always collective, about organizing, about people of all ages and identities, and it was for the young people. He always talked about "young people," not children, not kids, not kiddos. He respected young people, believed them capable of demanding more, and worked tirelessly to build what he called "the demand side" of the need for quality public education.

For three summers, Bob taught a group of young people here on our campus. During the year, they were in high school in a nearby community, but, as Black learners, their sense of themselves as math learners and more had been distorted by the deficit narratives that swirled around them, narratives that told them that they could not be doers of mathematics, and that they did not need it. Watching Bob, once again, working from his deep convictions about the necessity of organizing for change, insist that the young people think, try, learn, and expect more, demand more. The young people were essential to the push for a quality public education, even as it was the right he believed they should claim. His teaching mirrored what I had seen him do in other settings—a deliberate design for the problems they would explore, silences that pulled them in and got them to talk, to ask, to push back. As a teacher myself, I was moved by the power of his immutable faith in the young people's possibilities and the insight that they were essential to the work of raising the floor and guaranteeing the right to a quality public education.

Organizing, whether for the sharecroppers' right to vote or for young people's right to a mathematics education organizing depended on teaching. And teaching depended on organizing people to demand, to want, to insist. For Bob, organizing and teaching went hand in hand.

These memories of Bob Moses and so many more have given each of us much to be grateful for. But Bob did not do his work for us to be grateful for him. For Bob, it was not—and must not-be about him. For Bob the teacher, the people were the center, the end goal, the point. And what he has given us from the way he lived and taught are the stuff of learning to do the work of pursuing and ensuring justice.

Memory, and the act of remembering, are special human capacities. Remembering is active. It is also a gift, a resource. We can keep getting to know Bob even now. We thereby make his memory for a blessing. We can commit to actively continue to learn more about what Bob was teaching us and to act in this world on those teachings. We can retrace and remember examples of things Bob said, did, and quietly showed—maybe quietly but incredibly powerfully. Being inspired by his life, his ways of relating to others, his fierce commitments and his steadfast commitment to acting upon them—these provide curriculum for us as we continue the struggle for justice. As we continue to fight for the fundamental human and civil right



Figure 5. Bob Moses at the MSRI Critical Issues in Mathematics Education Workshop in 2007.

for a quality education, Bob has taught us each so much to support our work. We can still learn from him. And in doing so, we can, collectively and individually, make Bob Moses's memory for a blessing as we move forward.

Herbert Clemens

Very occasionally in one's life, that first encounter with an individual strikes some inner chord that elicits a quiet but powerful "oh yes." Even more rarely, that initial affirmation does not disappoint, weeks, years, even decades later. So it was in my own life when a selfless example led me to first awakenings about social justice, so it has been with a couple of mathematicians over the years who understood things I wanted to understand, in the way I wanted to understand them, but much better than I ever could, and so it was with Bob Moses.

With an almost Lincolnesque scope and vision, he was able in his soft-spoken way to put the great issues of his day and his people and by inference the rest of us in an ineluctable moral and historical context. He made one feel reverence for the nobility of the concept of a nation "so conceived and so dedicated" and also feel the reality of how cravenly, even criminally, we have often behaved in the avoidance of those noble ideals.

I first heard Bob Moses speak in the early days of the MSRI Critical Issues in Mathematics Education program, and like many others, I was blown away. He made the seemingly unlikely parallel between the plight of those who were denied the vote in the 20th century and those whose circumstances of poverty and marginalization effectively deny them math education in the 21st century. He spoke of "earned insurgency" as a necessity in both settings. Just like in political struggle, when young people set out to learn math, personal struggle, commitment, and trust in the worthiness of the goal are all required.

There is almost certainly no one way to teach mathematics, it is probably at its best when it is attuned to each teacher's and each student's individual way of coming to terms with concepts of "quantity" and "space" in their own heads. But there are a couple of things that are universally necessary, namely student trust in the teacher and willingness of both to do the work. We as a profession and our country as a society would probably be a lot further along in the trust and mutual respect department if we tried harder to live and work as Bob Moses did.

As I wrote this, I tried to reflect a bit on what Bob Moses's example has meant for me in my own political and professional life. I was good at math but not so good that dedicating my professional life exclusively to math would pass my personal "worthiness of the goal" test. Bob Moses's leadership, over the last couple of decades that I have known him, continually reminded me of the need to do more, to contribute more to others and to society. He said it eloquently with words but he said it even more persuasively with the way he lived, all the way up to his very last days. His unwavering vision and his awe-inspiring personal courage, especially during the years in Mississippi in the 1960s, are worthy of a singular place in the arc of our nation's history, bending it a little bit more towards justice.

Michael Nettles

Bob Moses and Educational Testing Service (ETS) began getting acquainted in the fall of 2011. At the time, Bob was a visiting professor in the Department of African American Studies at Princeton University. Bob's host at the university, Professor Eddie Glaude, thought that ETS would be an ideal place for Bob to address challenges concerning equity and quality mathematics education, so he introduced Bob to me. Bob and the Algebra Project turned out to be highly productive and beneficial collaborators for ETS throughout the remaining years of Bob's life.

After his initial visit to ETS, I began calling colleagues who were mathematics, language assessment, and research experts to join our conversation and to listen to Bob as he spoke about the language and social class barriers that needed to be overcome in teaching, learning, and assessment in mathematics in the United States, citing seemingly unlimited examples and bringing to bear his unique, vast experiences.

Bob, the Algebra Project, and ETS found common ground with these challenges, and ETS began realizing the potential of the Algebra Project as a vehicle for connecting with the bottom quartile of learners. Bob came with

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theories, a rich and deep history of experience, and expertise in mathematics, politics, and human interaction. At ETS, we had much to learn and were eager to collaborate. Our initial project together was a joint NSF grant in 2013–2014 to develop a logic model and theory of action for the Algebra Project. From there, in the Atlanta Public Schools in the school year 2015–2016, we joined the Algebra Project's teaching of mathematics to cohorts of high school students by producing the first large-scale standardized assessments for selected Algebra Project modules.

Edith Aurora Graf

I was introduced to Bob by Michael and his colleague Jon Rochkind at a meeting at ETS. He asked me if I had considered the role of language in mathematics instruction and assessment. I had read some influential literature on the role of vocabulary and language on mathematics assessment performance, and we discussed this a bit. Over the years, I have reflected on Bob's question and now interpret it much more broadly: I think he was asking me to reflect on the role of language in the development of mathematical thinking-his question was not limited to the role of language in performance on a single assessment event. It has often been the case that Bob's words had one meaning for me when I first read or heard them, but that they took on a deeper meaning as I learned more about the history of the Algebra Project or the Algebra Project's "five-step" curricular process.

This short story parallels the experience in working on two NSF-supported projects. In the first project, colleagues at the Algebra Project, ETS, Southern Illinois University Edwardsville, and the Young People's Project (YPP) collaborated on designing tasks that would assess student understanding with respect to a learning progression for the concept of function. As part of that work, YPP staff conducted focus groups and cognitive interviews to learn more about how students were interpreting the tasks. Per my initial interpretation of Bob's question, we learned a lot about the role of language and vocabulary in the interpretation of mathematics tasks.

One of my ETS colleagues, Jessica Andrews-Todd, is an expert in collaborative problem-solving. We reached out to her to join us in proposing a second project that would support small-team collaboration on the mathematics tasks. Such work would, we felt, be aligned with the Algebra Project's approach of encouraging group work. In addition, we proposed that some proportion of the team conversations be facilitated by college math literacy workers (CMLWs) from YPP. And so, our second grant was awarded and has been ongoing for about a year now. We hope that this project can support Bob's legacy and provide some answers to his broader question about how language and discourse can play a role in mathematics instruction and assessment.

Julia Aguirre

It is not every day that you get to talk with someone whose work affirmed and transformed your work as a justicefocused math educator. It was 2005, and I was attending my first MSRI Critical Issues in Mathematics Education conference. Bob Moses was a conference organizer and presenter. He was also scheduled to do a series of talks in the Monterey Bay area. I was a biracial Chicana and assistant professor at UC Santa Cruz, mother of a toddler and an infant, and focused on my work as an equity-scholar in mathematics education. I was fortunate enough to get a poster accepted at the conference and was asked if I would bring Bob to Monterey for his next speaking engagement. This was a 2-hour car ride. What would we talk about?

A couple of years before I had read the book, Radical equations [1] while on a camping trip with my future husband. I knew about the Algebra Project, but the book helped me understand its origins. The community organizing principles applied in the 1960s to register Black sharecroppers who could not read to vote were being applied to teaching disenfranchised young people Algebra, a highly coveted domain of mathematics that was a gatekeeper in American education. I was taken by the metaphor of the "bouncing ball" to attract middle school students to come and learn mathematics, while at the same time arguing to adults in power that mathematics literacy, and algebra specifically, was a civil rights issue of the 21st century. I remember feeling empowered with this because it was an argument that I had previously heard. It provided me with a powerful tool to create counter narratives to the dominant view held by many educators, scholars, politicians, and parents questioning whether all students should or could learn algebra.

There was a profound moment for me at the 2005 conference where I witnessed the power of generational love, that Bob had for young people. As part of the conference, a group of Black and Latinx high school students from a public school whose math department was de-tracking were invited to do a live math class in front of 200 mathematicians, math educators, and teachers. The young people walked in the auditorium and proceeded to the stage area where tables and chairs were set up. As the lesson was about to start, a young Black male student with headphones on, walked slowly down the stairs. Bob Moses

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stopped him and asked him to think for a moment, to recognize the implications of his actions, to consider what it meant to his classmates, teacher, and those waiting. Everyone was stunned. Discomfort filled the air as the young man looked apologetically to Bob. Then, his classmates began to applaud, all of them. They recognized what happened, for this was not the first time this student made a late entrance. But this time, someone was holding him accountable for his actions—a valuable lesson. Bob had calmly yet firmly called this child in with generational love of an elder, a grandfather, mentor, and as a Black man. He was the only person in the room who could have done that. It was beautiful.

As the conference ended, I escorted Bob to my car. I don't remember what we talked about but I remember playing jazz music. I remember watching him stare out the window as we passed the strawberry and artichoke fields of Watsonville, California with farmworkers stooped over in the afternoon sun. He was quiet, listening as I explained that the Central Coast was where organizing for farmworker rights happened under the leadership of Cesar Chavez and Delores Huerta. I wondered what he was thinking at that moment. Were there echoes of Mississippi in the sunlight?



Figure 6. Julia Aguirre and Bob Moses at the TODOS Math for all Conference.

The next day he arrived to a room full of professors, graduate students, undergraduates, and community members eager to hear him talk about mathematics as a civil right. I was asked to introduce him. I remember sitting next to him and starting. As I got to the part of how his work influenced mine, I was overwhelmed with tears. Still to

this day, I tear up when I think about it. The tears reflect a profound respect, faith, patience, and perseverance needed for this justice work. He lived through and fought for the right to vote and now he was helping me and future generations learn again that the fight for justice is based in community and love.

I met Bob again at the TODOS Math For All Conference. The board of directors offered him a slot to share his ideas about a national campaign to make quality education a constitutional right with participants and start to get folks organizing. Bob also asked if he could participate in the leadership session on equity and justice in mathematics education that I and my colleagues were facilitating. While I am no stranger to facilitating professional development to mathematics teacher educators and leaders, Bob's presence was like having the great Ella Fitzgerald coming to watch you sing jazz. It was an honor to have him there and I think we hit the right notes.

Thank you for the lessons and the opportunities. I am forever grateful.

Lee J. McEwan

My first encounter with Bob Moses happened in the evening on a cold day in December 2008. I picked him up at the Cleveland airport and drove him an hour south to a hotel in Mansfield, Ohio. We were both introverts, and Bob initiated most of the conversation. Although I was in my fifties, talking to Bob brought flashbacks of graduate school anxiety. He was excruciatingly precise, soft voiced, profoundly serious, and seemed to carefully evaluate everything I said. Over the next decade I got used to the fact that when Bob was with you, he was entirely present and never drifted off in his own thoughts.

When we got to the hotel, I made sure Bob was checked in and prepared to bid goodnight. But Bob started telling me about how his work proceeded. Standing in the cold evening air, I received a half-hour master class in organizing, which began a decades-long chapter in my life. "When a person gets a problem, usually he starts to think about how to solve the problem. When an organizer gets a problem, he thinks about 'Who can I get to work on this problem?'"

Regarding education in the current century, Bob told me "The mathematicians have been dealt a surprising hand." He viewed math literacy as a sine qua non of citizenship and access to the economy, and believed that the lack of such literacy disproportionately hurts marginalized communities. In subsequent years, as I supported the implementation of the Algebra Project in a local high school, my ideas about teaching changed. I no longer think in terms of lecturing as a way to teach mathematics to nonmajors. "There is no cookie cutter" for curriculum, and Bob preferred that they be shared and adapted to different local settings. My years with Bob Moses convinced me that professional mathematicians need to take on the problem of how to teach mathematics to future teachers, that they might teach students to think mathematically, and not regard mathematics as a collection of algorithms to be mastered.

Erica Walker

I first met Bob Moses when I was leaving Cambridge to join the Program in Mathematics at Teachers College,

Erica Walker is the dean of the Ontario Institute for Studies in Education at the University of Toronto.



Figure 7. Bob Moses at a Family Math Night with the Mansfield Ohio Algebra Project.

Columbia University. Ben Moynihan had a lot to do with it—Ben had been my classmate at the Harvard Graduate School of Education. When Ben found out I was in mathematics education and I figured out that he worked with the great Bob Moses, Ben very kindly introduced me to him. It was a moment for which I am so grateful, and that has inspired much of my work in mathematics education.

The book Radical Equations [1], had a profound effect on me, as a daughter of the South. Bob and his coauthor Charlie Cobb captured in words, recommendations, and actions, the feel and the strength of the Black community's love for education that I had always known in my church, my neighborhood, and my schools in Atlanta, Georgia. Always a teacher, his connecting the work of the Civil Rights Movement and his strategies for educating fellow Americans about their rights to a movement for math literacy and power was groundbreaking, and proof that education in its many forms transcends place and our often limited notions of how and where we learn and what it means to learn. Bob clearly saw people of all ages for their talent and understood that the work of a teacher is to help cultivate, nurture, and channel their dreams and interests for learning. His conceptions of (mathematics) education give freedom to us as educators and researchers to broaden our own views. As someone who approaches research in mathematics education from multiple interdisciplinary perspectives, his thinking and theorization of education has been an inspiration.

Over the years, my path crossed several times with Bob's and his beloved Algebra Project. He was tremendously kind and always gave you his undivided attention with an engaged intensity for listening to what you had to say. Children especially loved him. Whenever I saw him engage with young people I was reminded of those wonderful times growing up when a neighbor or teacher demonstrated such care and interest in our learning and development. He gave several talks at Teachers College, and he and his team invited me several times to be part of Algebra Project convenings and conversations where I had the chance to meet other incredible colleagues and collaborators. In the summer of 2011, he very kindly wrote a powerful foreword to my first book, *Building Mathematics Learning Communities in Urban High Schools*, and used a lovingly familiar pattern of refrain (in this case, the phrase *"Worthy of our attention"*) in the traditions of Black storytelling. I love reading it. *"Worthy."* It reminds us of the moral imperative of education, something that is too often lost in all of our un-nuanced discourse about schools and teaching and learning, and that advancement often requires challenge and confrontation to make things right. *"Worthy."* He reminds us of young people's power, and the power of their energy and passion and how they must be channeled for educational advancement.

Later that year, I visited Bob when he was Distinguished Visiting Fellow in the Center for African American Studies at Princeton. On a crisp October day, in a warm sunlit office, Bob shared with me his recent work and plans to craft a new movement about quality education as a constitutional right. We talked and thought and delved into pamphlets and books and papers about what rights mean in this country and Bob's vision for strategies for this (new) movement. Hours later, I left to take the train back to New York, my mind spinning with new and old ideas, connected in exciting and transformative ways. That always happened when and wherever I saw Bob.

Bob's work in mathematics education has been tremendously influential, generative, and inspirational to generations of students, teachers, administrators, researchers, and policymakers and will continue to be for generations to come. He was committed to mathematics and making it a better discipline, with access and opportunity for all. He will always be an influential part of the discourse about mathematics education within and beyond schools, pre-K through postsecondary.

These are among the many gifts that Bob has so generously shared with us, rooted in a deep and abiding love of Black people. We can't forget that, and we must continue to press on. He would expect that, and lovingly demand it.

Robert Berry

Bob Moses has influenced my work by pushing me to use mathematics as a tool for social justice to support the development of mathematical literacy among young people. His work took on a social justice stance rooted in the Civil Rights Movement's legacy. Consequently, as a mathematics educator engaged in social justice and mathematical literacy work, I owe him a debt of gratitude.

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Bob's work helped me understand that the power of education is in supporting people to think critically about the issues impacting our communities. Critical thinking is at the heart of mathematical literacy. Bob stated, "that the absence of math literacy in urban and rural communities throughout this country is an issue—as urgent as the lack of registered Black voters in Mississippi was in 1961" [1]. I have learned that mathematical literacy provides access to opportunities that would enable people to improve the social and economic conditions of their communities. For example, mathematical literacy helps us understand the economic impact of livable wages, the political influence of gerrymandering, and the social impact of racial profiling. Mathematics literacy underlies much of the fabric of society, such as economic justice, environmental rights, health, immigration, gender equity, racial equity, and civil rights. Critical thinking and mathematics literacy allow people to explain inequities and offer possible solutions, and participate in a democratic society.

In [1], Moses connects civil rights with mathematics by stating, "Algebra is a civil right." As a civil right, mathematics provides college access, thus a possible way to help people out of poverty. Moses is unique in his perspective because he used his experiences and tactics as a civil rights leader to create the Algebra Project, a culturally responsive curriculum that organizes communities around mathematical literacy.

In *Radical Equations*, Bob Moses discusses the importance of amplifying the voices of the youth voice and activism through mathematics. He said,

"We don't listen to kids enough. Really listen. It is a difficult thing for grown-ups to do—listen and actually pay attention to what young people are saying. In the Algebra Project, we are still learning how to do this also. It is the voices of young people I hear every day, more than anything, that gives me hope."

Much of my work has been to create spaces where young people can speak, be heard, and be seen. Therefore, I strongly appreciate Bob's perspective on listening to and learning from young people. Young people provide insightful perspectives for reading, writing, mathematizing, and critiquing the issues impacting them and the broader communities.

Bob Moses's legacy is represented in the many mathematics teachers, mathematics educators, mathematicians, and youth leaders whose work sits at the intersection of mathematics, social justice, and civil rights. Many of us believe that one of the civil rights issues of our day is mathematical literacy because it contributes to people's ability to work and participate in a democratic society. We all are thankful for Bob Moses, who provided us with a framework to engage in our work and a model of excellence in very modest ways. Bob Moses's legacy lives on through our work.

Robin T. Wilson

I first met Bob Moses in my second year in the doctoral program in Mathematics at UC Davis, when I was having a hard time finding the motivation to finish. In many ways, he came into my life at just the right time. It wasn't that I doubted I could do it, but I was having some real doubts about why I was pursuing an advanced degree in mathematics and whether this was just to pad my own ego, or if it could be something more—something that could be of service to my community in a meaningful way.

One day I got a call from my mother inviting me to hear Bob speak at a Sacramento City Unified School District teacher Professional Development workshop. After the event, to my delight I ended up giving him a ride to the airport. In the car he invited me to visit Lanier High School in Jackson, Mississippi where he was teaching. I took him up on the offer.

Lanier was the lowest performing high school, in the lowest performing county, in the lowest performing state in terms of the Nation's math literacy metrics. And at Lanier, Bob worked with the lowest performing students. He felt like those were the students that mattered most, the ones that were the most underserved by the system. I got to watch him in action as a teacher with these students and I saw how much he believed in them, and how unafraid he was to present them with a challenge. And then he passed the reigns to me, and I had to teach these students with him there. I had to find the same deep belief in their ability, and I had to find that same deep belief in myself that teaching these students was something I could do. For Bob, doing mathematics with these students, holding these students to high expectations while holding onto an unshakeable faith in their brilliance, was a radical act. And it was an act of organizing, a political act to be doing mathematics with these students at this high school in this state. I learned so much from him that afternoon.

After that trip, I kept getting invited back to Algebra Project events. In the 2000s, I attended several meetings in Miami for the Algebra Project's NSF grant to develop high school curricula. There I met other mathematicians like Greg Budzban, Ed Dubinsky, David Henderson, and Staffas Broussard, who were senior to me but had come to the Algebra Project for the same reasons. I met lots of math teachers and students too. In the Algebra Project, we all found something more that our mathematics training could be used for. By teaching mathematics to the students most underserved we could contribute to the movement and the struggle for the future of this nation. Bob helped us see the role we mathematicians had to play in this struggle and convinced us of its importance. We heard his call and were willing to put our training as mathematicians in service of a different kind of calling.

He showed us that as mathematicians we had an important role to play in the outcome of America's great democratic experiment. He showed me personally that mathematics was not just about theorems, beauty, and creativity. Bob showed me that, in addition to all of these things, mathematics could be a tool that we can use to organize for social justice. It was a tool that, if given to the children, they could use to continue this fight after we are gone.

Bob knew he would likely not live to see the fruits of his labor, and he was ok with that. It's really something to live knowing that you will never see the freedom that you are fighting for, but at the same time keep fighting like victory is just around the corner. The Algebra Project is celebrating 40 years of existence, founded in 1982 when Bob won a MacArthur "genius award." And he felt like we might have 50 years to go from here before we find victory in this movement. There is only one way to prepare for that kind of fight. It's to turn to the children, to the youth, to prepare them to take up the baton and lead the way. That's why Bob turned his attention to the youth. And that's what Bob saw in me, back when I was still a young person in my 20s.

Perhaps the most valuable lesson I learned from Bob was that "there could be life worth living in the struggle." I have never seen the kind of commitment to a cause that Bob had for this movement. It was his life which became a central part of his family's life as well, and he brought me into that and made me feel like family. He made me feel that I was a part of something bigger than myself. Bigger than the institutions I was involved with. Bigger even, than mathematics itself.

Maisha Moses

When I think about Dad's work and his legacy, I go back to my high school days, when I became more aware of his history. I remember asking him what the Movement had meant to him. He thought for a second, and said, "Freedom." And he said it so strongly and so powerfully, it just resonated with me.

In retrospect, I think Dad found himself in the Movement. His decision to go South in 1960 and give his life to the Movement really changed and shaped the arc of his whole life. This was the big theme for him—freedom. As an African child growing up in America, my dad seemed always to be figuring out how to find his place in America. Then later, as a Black man in the 1950s and 1960s, he began discovering how to carve his space in this American society. The Movement was an answer to a very deep searching that he underwent across his childhood and young adulthood.

Much later, he started the Algebra Project (AP) partly because his passion and studies were mathematics, the philosophy of mathematics—he possessed that very natural love—yet his life's mission was about freedom. So, the Algebra Project became a marriage of those two big themes in his life. He always told my siblings and me that you can live a meaningful life in struggle—a life which included facing the weight of our country's history. Dad developed this recognition about Black life primarily through the Movement and its elders, and then he kept it alive in his AP work.

Subsequently, Dad taught me that what it takes to make change in this country is an ongoing, enduring, consistent commitment to struggle; discovering how to struggle; knowing who your friends are in the struggle and how to work together; knowing how to name a problem and how to craft a solution to that problem. As I think about the arc of his life and his legacy, those are the broad strokes that sit with me now—AP and the Freedom Struggle.

His AP work began while he, as a parent, was trying to ensure that we got a good education. Because I was tired of doing math with him at home, Dad came into my classroom to teach me math. Then and there, he again saw the ways education functions to sort people—and how it continues to be a deep manifestation of America's caste system. So, he became my algebra teacher in eighth grade. And because he was teaching me, I became the only Black student in the highest-level math class. We had been sorted into ability groups, and the ability groups just fell along race and class lines. Though this was decades ago, Cambridge public schools and the nation are still struggling with this issue—and it's very explicit in mathematics education.

Dad's Movement eyes saw the ways in which Black, Latino, and poor children were not getting access to the highest levels of math education that their school districts were offering others. But he also understood, way back in the 1980s when he was starting the Algebra Project, that math literacy was becoming, on the eve of the 21st Century, as important a literacy as reading and writing. I believe he was ahead of his time because he was one of the earliest people to consider math literacy as a civil right in a 21st Century, knowledge-driven, technology-driven economy.

Moreover, he explained that young people today, who don't get mathematics education, will be like serfs on a plantation during the first half of the 20th century. When we talk now about the obstacles that this generation is

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Figure 8. Students and teachers playing the Flagway game at a Young People's Project event.

facing around freedom, access, and equity, I continue reflecting on how Dad recognized very early that math literacy is key to students' success in gaining first-class citizen rights—most people just weren't thinking about it in that way.

But most of what I learned from Dad, I learned from spending a long time around him as he worked. And always, it was his patience that struck me. Dad just had a way of being with people, working with and connecting to people where they are, wherever that is. His patience enabled most of us to connect to this big vision, this epic struggle that his life was about—he gave people time to discover how to connect their lives to this broader struggle. The way he worked with a child one-on-one doing math, or with student groups, teachers; or the way he gave talks— I would say that's a lot of what I carry with me and shapes how I do my work.

His communicating to us his understanding of this movement that we're in today helped shape the Young People's Project's (YPP) philosophy. He insisted that the movement around math literacy requires the people who are most directly affected by the problem, make demands on their own behalf while they struggle and organize to create solutions to the problem. And in education, that's the children, the young people. And so, he drummed that message into my brother, Omo, who started YPP; Albert Sykes; and his classmates who then were in middle school—insisting that their role, their work, their energy in this math literacy work was critical, even essential.

And, that's the essence of what the Young People's Project does. It is figuring out how to create spaces with that intent in mind, that young people must be at the center of making change in education. Obviously, not the only people. It takes everybody, but without the students, it's not sufficient nor successful.

YPP grew from the Algebra Project. And AP has made a huge contribution to the world of math education,

through its curricular process and pedagogy, which takes ordinary events or experiences that people have and goes through a process, the AP "five-step" process, to abstract the mathematics out of those events. When I was training and teaching with AP, so many teachers said, "If I had learned math this way, then I would understand it." That process was a significant intellectual contribution to the field of math education. And, of course, connecting it to citizenship and broader issues of equity was genius.

So, the Young People's Project inherited Dad's thinking about algebra as a right; its approach to grounding math in experiences, games and activities; and using student language to talk about math. Dad insisted that "Mathematics is not a language that anybody speaks." So, the question becomes how to help children learn to relate their natural language, whatever it is, to the language of mathematics.

YPP applied these concepts to developing young people as teachers of mathematics. We expanded AP's idea of knowledge work, that there's a powerful role young people can uniquely play in learning bits and pieces of math well enough to teach it to their peers. But that idea challenges the more traditional approaches to math teaching and learning, approaches that aren't working for far too many. AP/YPP process is a tool for democratizing who has a voice in the learning space; it allows youth to become teacher and learner and agents of change, making a demand on a system that historically silences them.

And for teachers, it creates a process to step out of that position as "the source" of all knowledge. School districts, teachers, communities don't necessarily look at the kids, especially the kids who are struggling, and see them as assets and think, "How do I tap into all of the strengths that they're bringing to the table, to help us work on these problems that we're having." Rather, they continue to see the kids themselves as the problem.

Finally, my dad was the first person that made me aware of the ways education functions to perpetuate a caste system. For a long time, he talked about sharecropper education. And then he came across a book, *Slums and Suburbs*, by James Bryant Conant, a former Harvard president and founder of ETS [14]. Conant's research led him to the understanding that the North and South after the Civil War, agreed to keep "the Negro" in a tight caste system, and Conant said, "the clearest manifestation of America's caste system is in its education system."

And so, central to our work is exploring how we play a role through mathematics education in breaking down that system of caste. In that work, we ask how do teachers and students reckon with the perpetuation of caste in education? How do they understand their everyday relationship to it? How in such a system could every teacher, student, professional developer become a freedom fighter?

And could it be that the two themes of freedom and mathematics in my dad's life calls to us all?



Figure 9. Bob and his daughter, Maisha Moses.

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