Equity and Mathematics:

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An Interview with Deborah Ball and Bob Moses

When Algebra Project creator Bob Moses and math researcher Deborah Ball talk, their conversation is less about the mechanics of math and more about issues of equity and education.

By Joan Richardson

KAPPAN: I'm always curious about how people arrived where they did in their professions. How did you both get interested in math? How did you become interested in math education?

BOB MOSES: I went through public schools in New York City, through PS 90 in

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the early Forties. After World War II, the nation went on a talent search. So when I graduated from the 6th grade, we were told that a small group of us would join students from every elementary school in Harlem and the South Bronx in what they called a "rapid advance" class. So we did junior high school in 2½ years instead of three. I had an algebra teacher who was really very good there. After Stuyvesant High School, I went to Hamilton College, where I had my first experience with someone in the philosophy department who was writing a logic textbook. That blew my mind. I didn't know people actually did that. I became the best logic student. But I was interested in philosophy. That sent me to Harvard University [where he earned a master's degree in philosophy]. Harvard's philosophy department was oriented to analytic philosophy, and Willard Van Orman Quine and other people were really focused on philosophy and math. I don't think I could have gotten the insights that have driven the Algebra Project from doing a major in math because the basic insights deal with philosophy's penchant for taking apart and putting back together the concepts everyone else takes for granted. That's what philosophers like to do. That really has been my particular input into the work of the project around elementary algebra. [Editor's note: One of Quine's ideas that Moses drew on for the Algebra Project was that students first need to understand math through everyday language before they can translate that into the more abstract language of mathematics. For example, before introducing students to the concept of a number line, Moses' teachers first introduced students to a train line with many stops between its beginning and its destination.]

KAPPAN: Deborah, you got to math in a completely different way, right?

DEBORAH BALL: Totally. I have no special history in math until much later in my life. I was a French major in college. When I was in high school, graduation requirements were very relaxed and kids could take pretty much whatever they wanted. So I took every humanities course, every English course. I took three languages and had one year of math and one year of science when I graduated from high school [in Iowa City, Iowa]. In college, I was a French major, which mostly means that you read, write, and speak in French but you study philosophy. That's actually a relevant clue because the content of the French major is actually philosophy; the mode of working on it is language.

Then, I became an elementary school teacher because I thought I would find teaching very intellectually interesting work, and that was true. After five or six years of teaching elementary school, I found my students were not learning math. I wasn't teaching it very well. On Friday, they would know how to do something and on Monday, they wouldn't remember.

That year, I was teaching 5th grade. I began to take more seriously what it would take for me to be better at reaching my students. So I began to study mathematics. I thought part of the clue was that I hadn't really studied much math myself and that maybe it would help if I did. So I began taking college-level math. I found it pretty interesting.

I did well in those classes, but it wasn't quite clear to me how this was going to help me teach school better. Then I took number theory, which electrified me. I just loved it. I learned much more about how to think mathematically and about proof.

Meanwhile, I was teaching 1st grade. I began experimenting a lot more with what I was doing with my students. I began to notice that the math I was taking was influencing what I could hear and

Robert P. Moses
Position: President and founder, Algebra Project.
Age: 74
Education: Bachelor's degree in philosophy and French, Hamilton College, 1956. Master's degree in philosophy from Harvard University, 1957.
Professional history: Founded the Algebra Project in 1982 by using his MacArthur Fellowship award. Served as field secretary for the Student Nonviolent Coordinating Committee (SNCC) and director of SNCC's Mississippi Project. A driving force behind the Mississippi Summer Project, which organized the Mississippi Freedom Democratic Party (MFDP) and challenged the Mississippi regulars at the Democratic Party Convention in 1964. Worked for the Ministry of Education in Tanzania, East Africa, where he chaired the math department at the Sam school, 1969-1976. MacArthur Foundation Fellow, 1982-87.

What is the Algebra Project?
The Algebra Project is a national U.S. mathematics literacy effort aimed at helping low-income students and students of color acquire the mathematical skills that are necessary for "full citizenship in today's technological society." This means accelerating students performing in the lowest quartile on standardized tests to make a demand on themselves and their peers to successfully pass state, national (ACT/SAT), and college entrance exams so they do not require remediation and can enroll in college courses for credit, and so that math will not be an obstacle for a choice of major or career.

The Algebra Project has developed curricular materials and provided intensive teacher professional development institutes and ongoing support, as well as community involvement activities, to schools seeking to achieve a systemic change in mathematics education. The Algebra Project reaches about 10,000 students and 200 teachers each year through work in 15 locations in 11 states.

In 2005, the Algebra Project initiated Quality Education as a Civil Right (QECR), a groundbreaking national organizing effort to establish a federal constitutional guarantee for quality public education for all youth.

www.algebra.org

what my students said. I noticed them saying things that I had never noticed before. I realized that the kids were doing all kinds of mathematical things that teachers were missing, which, to me, had everything to do with kids' failure in math. Kids would say interesting things and their teachers would say, "No, don't do it that way" or "We're not talking about that" or "That has nothing to do with what we're talking about." Then, it would be pretty easy to explain why lots of kids would end up thinking, "This is a dumb subject and I'm checking out of this," because they were thinking things that were mathematically viable but most primary teachers couldn't hear it.

The mathematical foundation in the elementary grades has everything to do with what comes later. Having a very different early experience, even from before entering school, would make a very big difference. Kids would come to high school with different expectations about what they do. We're working in a repair mode right now because they come to high school already completely harmed by what school does with math. So it's a huge repair job. So I'm not really a math person is the basic story.

MOSES: Why do you say that?

BALL: I'm basically an outsider to the field of mathematics, and I think what I've been is a tourist of it. That perspective has allowed me to learn things about the culture of mathematics. I've learned to appreciate how central language is in mathematics, which was something I was interested in anyway. I've learned to appreciate some aspects of what makes mathematics really fascinating that I might not have seen if I was an insider.

I'm making a career out of the fact that I'm not good at math because I'm so bent on figuring out what it would look like if all kids in this country actually had the foundation that mathematics would provide.

— Deborah Ball

WHY ALGEBRA?

KAPPAN: Let's shift the conversation a bit and talk about algebra. Mathematicians may understand why algebra is getting so much attention, but I'm not sure most of the rest of us understand that. What is it about algebra that makes it so significant for students to study?

MOSES: In this country, it's important because we've decided it will be the entry point to advanced math. France uses geometry as its entry point. We've shifted from an industrial technology to information-age technology. Computers have introduced the need for quantitative literacy. Where in the education system do you put the standard for quantitative literacy? In our country, we put it in algebra. Industrial technology required reading and writing literacy; information technology requires quantitative literacy.

When I was in Mississippi [in the 1960s], I saw very graphically how literacy mattered. Sharecroppers weren't literate, so they were outside the economic arrangement. That's what's happening now in the inner cities. We're growing young people who are outside the economic arrangements for the information-age technologies. It's not that they don't need reading and writing. They need higher levels of reading and writing because they have to communicate. But they also need the ability to encode and decode information, which is partially encoded with quantitative information. That's just one piece of why algebra is important.

BALL: The language of mathematics is a very powerful representational tool for being able to encode and decode. We actually don't teach it explicitly very much at all. People who become good at algebra are people who sort of generalize it or pick it up from the way it does get taught. But many, many people don't. I'm one of them. So, I've been struggling to make more of a point out of the connection for even very young kids. We do that much better with regular language than we do with this form of mathematical language. From very early ages, children should have experience with algebraic representations and reasoning so they'll get better and better at it over time.

When I watched my own kids going through junior high and high school, they were just suddenly using symbols, but nobody was really explaining very much at all about it. It's not explicitly taught. Yet it's pretty fundamental to doing mathematical things later. I don't think we're really teaching it to anybody. Kids who are learning it are mostly just picking it up.

KAPPAN: So we're teaching algebra widely now, ramping up our expectations for algebra because of workforce issues or because mathematical thinking improves our ability to think more deeply in other areas of study?

BALL: If you want to argue that there are aspects of both algebraic ideas and algebraic reasoning that are prerequisites for other mathematical work, then it's really premature to decide that some kids aren't going to want opportunities to do quantitative things for which that will be important. Why does it seem fair to decide that some 14-year-olds aren't going to be interested in that? At 14, that's what I would have decided. I would have decided, which I did basically, I'm not going to need any math. It produced an adult who actually had studied almost no math and who would not be able to pursue a mathematically

intensive career.

I'm making a career out of the fact that I'm not good at math because I'm so bent on figuring out what it would look like if all kids in this country actually had the foundation that mathematics would provide. By the way, I hope you notice that we don't ask this question about poetry. When I taught 1st grade, we studied poems and we didn't ask, "why is that going to be useful?" We also made sure people could learn to read and write. Some parts of math are just really interesting, and we aren't really exposing kids to that.

I'm on something of a mission of having this say, basically, either we're going to do this and do it well for everybody or we shouldn't be trying to do it at all. And if not, let's stop pretending math deserves to be one of the main school subjects. Let's take philosophy and art and teach it to everybody. We're not really teaching mathematics to most people in this country anyway. That's not completely answering your question, but I'm sort of asking why should math be there at all? If there is a good answer to that, it has to be a good answer for everyone.

KAPPAN: The other thing that's related to that is, is it appropriate to demand that students learn algebra at particular points in their educational career? For example, we have a couple of states that require students to take algebra in 8th grade and some that say students have to finish Algebra II in order to graduate from high school.

MOSES: I talked to a lady last week in Eldorado, Illinois, a town of about 4,000 where they've got all the same symptoms that we find in the inner city. This lady worked at the community college and said most of the kids coming out of the local school system go to the community college, where they spend two years taking remedial math before they can take a course for credit. That's an enormous cost for them and their families. In Miami, you have 60,000 kids in Miami-Dade Community College and tens of thousands of them are taking remedial math. They have to get through arithmetic, elementary algebra, a little more than elementary algebra, before they can take a course for credit. For these kids, given what the standards are at the level of the university and preparing for jobs of any kind, they don't have a choice.

We're a country that has an unannounced education policy that we tolerate failing schools.

— Bob Moses

There's no question that algebra is necessary. It's necessary given the political configuration of the country. There's no choice for them. Middle-class kids don't want the requirement; upper-middle-class kids have outs. They can go to colleges that don't require it. You can pay $40,000 a year and go to a small liberal arts college for which there is no really effective math requirement.

BALL: We have a country full of people who aren't particularly mathematically literate, so this is a hard conversation to have. If we were having the conversation about whether everyone should learn to read, that would sound pretty silly.

It's a hard conversation to have in this country. As Bob just said, kids who are very privileged manage to do without it, and so do lots of other people. But, for many kids, math will be the key thing for their life chances.

QUALITY MATH TEACHING

KAPPAN: Part of the challenge in ensuring that all kids have access to algebra is ensuring that we can provide teachers

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Position: Dean of the School of Education and William H. Payne Collegiate Professor, University of Michigan.
Age: 55
Education: Graduated with highest honors from Michigan State University with a bachelor's degree in French and elementary education, 1976; master's degree in teacher education from MSU, 1982; and Ph.D. in curriculum, teaching, and educational policy, MSU, 1988.
Professional history: Began her career as an elementary classroom teacher in East Lansing Public Schools, 1975-1992. Joined the faculty at Michigan State University, 1988-1991. Joined the faculty at University of Michigan, 1996. Named dean of school of education, 2005. Author or co-author of more than 150 publications. Her research has been recognized with numerous awards and honors.
Research focus: Mathematics instruction and interventions designed to improve its quality and effectiveness. Her research groups study the nature of the mathematical knowledge needed for teaching and develop survey measures that make possible analyses of the relations among teachers' mathematical knowledge, the quality of their teaching, and their students' performance.

Teaching mathematics requires specialized knowledge about the subject that mathematicians don't need.
Deborah Ball and Heather Hill explore this topic in the R&D column in this issue of *Kappan*. See pages 68-71.

who know and can teach the subject. Can this country do that? Do we need national standards in place to ensure that we do that?

MOSES: We don't have the political will to do it. We don't have the infrastructure even at the level of universities to actually do it. And we're caught up in a really historical legacy around "national" and "standards." Conservatives don't want national standards because they think it will pit the states versus the feds; liberals don't want standards because they're thinking about their children versus other children and what's best for their children might not be some standard. So we're caught up in this complexity, and it's not going to let us go.

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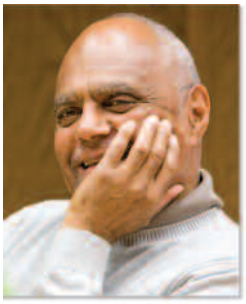

BALL: We don't have the infrastructure for reliably supplying teachers who know what they're doing. Not through higher education or through alternative routes. We spend a lot of time arguing about who should be providing teachers, but we have no infrastructure for actually building a cadre of people who would be skillful wherever they teach and who understand that that's their job. Their role is to make sure that every one of their students learns. We are as far from a system like that as you can imagine.

The question of a national agreement about what's important to learn is related. Imagine wanting to build a system where you supply teachers who actually know what they're doing. That's pretty hard to do when you can't agree on what they're going to teach when they get out there.

If we really wanted to build a system that couldn't work, we almost couldn't have done it better than we have.

I agree that it's about political will. It's about changing the conversation. It would involve cutting through these polarities about whether it's standards or whether it's federal or whether it's Teach for America or whether it's the ed schools or whether it's preservice or inservice. The problem is located in something much more fundamental. If we can get those things off the table, and actually work on the thing we have in front of us — which is to get ordinary adults who are really committed to having kids become skilled — we could do it. There's no shortage of people who want to try to do that, but we're not equipping them at all. It's like sending people out into a very difficult environment with almost no skills or tools to do it. No wonder they leave the profession.

MOSES: The country doesn't have any institutions or strategies for holding itself accountable for kids who are at the bottom or the bottom half and aren't making it through the system. This is not something teachers can solve by themselves. We're a country that has an unannounced education policy that we tolerate failing schools. We have policies that rescue various categories of students from these schools, but we really don't have a national policy to fix these schools. If you're sending teachers into these schools, you know in advance that the chances of them surviving and really changing things are not there.

BALL: We have to supply large numbers of adults in schools, and we have to build schools to house those kids and teachers that actually enable them to reach those goals. The reason some people are questioning standards is that it really does very little to simply announce that you have high standards.

That's the story in Michigan right now. We have hugely escalated standards, but we're going to have big waves of additional failure because we don't have enough in place to help those kids actually reach those standards.

We need a system that supplies teachers with the skills. My own view of this, and I think that of my colleagues, is that it's not a worthwhile argument to argue who will get the teachers ready. So, if Teach for America could do that or we could do that or you could learn that in an intensive four-week program, I really don't care. I care much more about making sure that nobody's in a classroom who's not safe to teach kids. One way to do that would be to spend more time worrying about the standards for good practices in teaching and finding ways to establish that people who enter classrooms can do those things. Then, I think we could build it. Recruit a lot of people who want to be teachers in different ways. Let it vary. That's fine. We actually need a diverse teaching population, so people need to be able to enter through different routes. But the important thing is that they need to be prepared for the work of teaching and skilled in helping all their students learn.

KAPPAN: Are there changes we should be making in teacher education that better prepare teachers for mathematics? For a long time there was the conversation about whether teachers should have degrees in education or if they should be content specialists.

BALL: That's an example of an argument that's not worth having. We have ample evidence that majoring in mathematics basically doesn't speak to the mathematical skill that you would use when you're teaching. We keep wanting to find easy outs and off-the-shelf solutions. A math major is an unreliable proxy for what a teacher needs. If you want to become a math teacher, maybe you need a different set of experiences than someone who majored in math. We need a very small set of essential, but specialized things. Some of them would be ethical commitments, some of them would be skills, and some of them would be a kind of mathematical knowledge specifically for teaching.

We shouldn't think it's okay to put

people in classrooms who don't know what they're doing. You don't think it's okay to have a plumber come to your house who might completely wreck your drain when your drain isn't working, or your toilet. We don't think it's okay if you go to get your hair cut and the person buzzes half your hair off. You don't go back. We're doing kind of the analog of that. We're having people who don't know what they're doing with our kids, and we somehow think that's okay. We think it's okay to let people who lack the skills to teach try to figure them out at the expense of the students in front of them.

MAKE MATH INTERESTING

KAPPAN: I talked recently with a young teacher who said one of her biggest frustrations was that students in 3rd or 4th grade already say they hate math and they're not good at math. So, one of her primary challenges is getting them past this belief that math is boring and that they're not going to be good at it. How do teachers address that?

MOSES: There are a lot of ways to address that problem, but it begins by the teacher recognizing that it's her problem, not a problem with her students.

I began to notice that the math I was taking was influencing what I could hear and what my students said.

— Deborah Ball

BALL: There is some evidence that babies develop taste for food by not having too narrow of a palette when they're being fed lots of different tastes when they're little. Kids decide they don't like math because they've had a diet of math that's like eating cardboard. It's not delicious, so they don't like it.

There are tons of problems that are fascinating to little kids, so you need to give them a diet of those things. They have to be able to see that math is something much broader than what school is causing them to think math is. Math needs to be defined more broadly. When I taught 1st grade, I discovered that it was much smarter to spend the early months on geometry because it broadened their sense right away of what the subject was. "Oh, that's math too? Well, if that's math, I kind of like that. And guess what, I'm actually pretty of good at it." So, that interplay of what it is and what it means to be good at it is important. K