

Acknowledgements

Putting together a book like this would not have been possible if it had not been for the support and work of many individuals. We would like to thank all those math teachers and authors we have worked with to include their writings and ideas in this book. We have learned from their teaching and writing as we hope the readers of this book will as well.

We would like to thank, in particular, Bill Bigelow, Rethinking Schools classroom editor, who worked closely with us giving advice and feedback on the book as a whole and many specific articles; Leon Lynn, Rethinking Schools book editor; and Catherine Capellaro, managing editor of *Rethinking Schools* magazine.

Eric Gutstein offers special thanks to the students and community of Rivera Elementary School, in Chicago, and to Pauline Lipman for her ever-critical support and analysis.

Bob Peterson thanks the fifth-grade students he has taught at La Escuela Fratney, in Milwaukee, many of whom have provided the inspiration and challenges that have helped him become the social justice teacher that he is. He also thanks the entire Fratney community and dedicated staff, who continue to inspire him. Finally, he thanks Barbara Miner for her support and feedback.

Rethinking Mathematics, like all Rethinking Schools books, was supported by the broader Rethinking Schools community, especially the editors, Wayne Au, Terry Burant, Linda Christensen, Stan Karp, Larry Miller, Kelley Dawson Salas, Rita Tenorio, and Stephanie Walters; and the editorial associates, David Levine and Kathy Swope; and the office staff, Mike Trokan and Susan Bates.

Introduction

I thought math was just a subject they implanted on us just because they felt like it, but now I realize that you could use math to defend your rights and realize the injustices around you... [N]ow I think math is truly necessary and, I have to admit it, kinda cool. It's sort of like a pass you could use to try to make the world a better place.

— Freida, ninth grade, Chicago Public Schools

Some students would prefer to have a dentist drill their teeth than to sit through a math class. Others view math class as a necessary but evil part of getting through school. Still others enjoy playing and working with numbers and problems.

We agree with Freida. Math is often taught in ways divorced from the real world. The alternative we propose in this book is to teach math in a way that helps students more clearly understand their lives in relation to their surroundings, and to see math as a tool to help make the world more equal and just.

In a “rethought” math class, teachers make mathematics more lively, accessible, and personally meaningful for students, who in turn learn in more depth.

The articles in this book provide examples of how to weave social justice issues throughout the mathematics curriculum and how to integrate mathematics into other curricular areas. This approach seeks to deepen students’ understanding of society and to prepare them to be critical, active participants in a democracy.

The elementary school, middle school, high school, and college teachers who have contributed to this book also note the many potential benefits of such a social justice approach to mathematics. Among them:

- Students can recognize the power of mathematics as an essential analytical tool to understand and potentially change the world, rather than merely regarding math as a collection of disconnected rules to be rote memorized and regurgitated.
- Students can deepen their understanding of important social issues, such as racism and sexism, as well as ecology and social class.
- Students can connect math with their own cultural and community histories and can appreciate the contributions that various cultures and peoples have made to mathematics.
- Students can understand their own power as active citizens in building a democratic society and become equipped to play a more active role in that society.
- Students can become more motivated to learn important mathematics.

These benefits come both when teachers reshape the mathematics curriculum with a social justice vision and when they integrate social justice mathematics across the curriculum into other subjects, such as social studies, science, health, reading, and writing.

An Essential Tool for Understanding and Changing the World

To have more than a surface understanding of important social and political issues, mathematics is essential. Without mathematics, it is impossible to fully understand a government budget, the impact of a war, the meaning of a national debt, or the long-term effects of a proposal such as the privatization of Social Security. The same is true with other social, ecological, and cultural issues: You need mathematics to have a deep grasp of the influence of advertising on children; the level of pollutants in the

water, air, and soil; and the dangers of the chemicals in the food we eat. Math helps students understand these issues, to see them in ways that are impossible without math; for example, by visually displaying data in graphs that otherwise might be incomprehensible or seemingly meaningless.

As an example, consider racial profiling. This issue only becomes meaningful when viewed through a mathematical lens, whether or not the “viewer” appreciates that she or he is using mathematics. That is, it is difficult to declare that racial profiling occurs unless there is a sufficiently large data set and a way to examine that data. If, for example, 30 percent of drivers in a given area are African Americans, and the police stop six African-American drivers and four white drivers, there is weak evidence that racial profiling exists. But if police stop 612 African-American drivers and 423 whites, then there is a much stronger case.

The explanation lies in mathematics: In an area where only 30 percent of the drivers are black, it is virtually impossible for almost 60 percent of more than 1,000 people stopped randomly by the police to be black.

The underlying mathematical ideas — (dis)proportionality, probability, randomness, sample size, and the law of large numbers (that over a sufficiently large data set, the results of a probability simulation or of real-world experiences should approximate the theoretical probabilities) — all become part of the context that students must understand to really see, and in turn demonstrate, that something is amiss. Thus with a large data set, one can assert that a real problem exists and further investigate racial profiling. For youth, racial profiling may mean being “picked on,” but the subtleties and implications are only comprehensible when the mathematical ideas are there. (See “Driving While Black or Brown,” page 16.)

When teachers weave social justice into the math curriculum and promote social justice math “across the curriculum,” students’ under-

standing of important social matters deepens. When teachers use data on sweatshop wages to teach accounting to high school students or multi-digit multiplication to upper-elementary students, students can learn math, but they can also learn something about the lives of people in various parts of the world and the relationship between the things we consume and their living conditions. (See “Sweatshop Accounting,” page 53, and “Sweatshop Math,” page 160.)

Moreover, to understand some issues, students need to combine math with other subjects. For example, although the government releases unemployment figures monthly, Marilyn Frankenstein explains in “Reading the World with Math” (page 19) that how unemployment figures are reported profoundly affects one’s understanding of what really goes on in our communities. Frankenstein points out that it’s easy enough to figure unemployment percentages, but who gets counted as unemployed and who is — or is not — considered part of the workforce are political questions. The unemployment rate changes depending on these decisions. Thus math needs social studies, and social studies needs math.

Connecting Math with Students’ Cultural and Community Histories

Rethinking math also means using culturally relevant practices that build on the knowledge and experiences of students and their communities. Many of these approaches have been developed by teachers and then described and theorized by researchers of color, such as Gloria Ladson-Billings and William Tate. A guiding principle behind much of this work is that teachers should view students’ home cultures and languages as strengths upon which to build, rather than as deficits for which to compensate. In “Race, Retrenchment, and the Reform of School Mathematics” (page 31), Tate offers the simple example of a teacher’s failure to reach her students because she uses story problems that are not grounded in the students’ culture;

while Luis Ortiz-Franco (“Chicanos Have Math in Their Blood,” page 70) encourages teachers to teach about the base-20 Mayan number system as a way to emphasize, to both Chicano students and others, that math has deep roots in indigenous cultures in the Americas. David Levine’s article about the Algebra Project started by Bob Moses (see “Radical Equations,” page 90) provides another example of teachers connecting with students’ cultural and community histories to promote deeper student learning. Moses summarized the importance of these connections in his book on the project:

[I]n the Algebra Project we are using a version of experiential learning; it starts with where the children are, experiences that they share. We get them to reflect on these, drawing on their common culture, then to form abstract conceptualizations out of their reflection, and then to apply the abstraction back on their experience.

You can think of it as a circle or clock: At 12 noon students have an experience; at a quarter past they are thinking about it; at half past they are doing some conceptual work around their reflections; and at a quarter to they are doing applications based on their conceptual work. In the Algebra Project this movement from experience to abstraction takes the form of a five-step process that introduces students to the idea that many important concepts of elementary algebra may be accessed through ordinary experiences. Each step is designed to help students bridge the transition from real life to mathematical language and operations.

Because of this connection with real life, the transition curriculum is not only experiential; it is also culturally based. The experiences must be meaningful in terms of the daily life and culture of the students. One key pedagogical problem addressed by the curriculum is that of providing an envi-

ronment where students can explore these ideas and effectively move toward their standard expression in school mathematics.

Understanding Their Power as Active Citizens

As students develop deeper understandings of social and ecological problems that we face, they also often recognize the importance of acting on their beliefs. This notion of nurturing what Henry Giroux has called “civic courage” — acting as if we live in a democracy — should be part of all educational settings, including mathematics classrooms.

Rethinking Mathematics spotlights several examples of student activism. These include fifth-grade Milwaukee students writing letters to social studies textbook publishers based on their mathematical analysis of slave-holding presidents and textbooks’ failure to address this issue (see “Write the Truth,” page 140); New York City students who measured their school space, calculated inequities, and then spoke out against these inequities in public forums (see “With Math, It’s Like You Have More Defense,” page 81); and students who used math to convince their school administration to stop making so many obtrusive PA announcements (see the activity “Tracking PA Announcements,” page 130).

Motivated to Learn Important Math

Engaging students in mathematics within social justice contexts increases students’ interest in math and also helps them learn important mathematics. Once they are engaged in a project, like finding the concentration of liquor stores in their neighborhood and comparing it to the concentration of liquor stores in a different community, they recognize the necessity and value of understanding concepts of area, density, and ratio. These topics are often approached abstractly or, at best, in relation to trivial subjects. Social justice math implicitly tells students: These skills help you understand your own lives — and the broader world — more clearly.

Getting Started

Teachers and preservice teachers sometimes ask: How do I get started integrating social justice concepts in my math class? Our best advice is to take a little at a time. One way is to identify a concept/skill that you are teaching as part of your regular curriculum and relate it to a lesson idea in this book (or on the website for this book, www.rethinkingschools.org/math). Teach the lesson or unit and then gauge how successful it was in terms of student motivation, student understanding of the math concepts, and the deepening of the students’ knowledge about the particular social issue.

Another way is to get to know your students and their communities well and listen closely to the issues they bring up. Many of our own social justice projects started from conversations with students about their lives or from knowing about issues in their communities. For example, see the activity “Environmental Hazards,” page 41, in which high school students investigate contamination in their own neighborhoods.

The media are also potential sources of projects, because current issues both affect students’ lives and have mathematical components that teachers can develop into social justice projects. For example, see “Home Buying While Brown or Black,” page 47.

Certainly working in a school that has a conceptually strong foundational mathematics curriculum is helpful. Teachers cannot easily do social justice mathematics teaching when using a rote, procedure-oriented mathematics curriculum. Likewise a text-driven, teacher-centered approach does not foster the kind of questioning and reflection that should take place in all classrooms, including those where math is studied.

By saying this, we do not wish to imply that if teachers use a conceptually based curriculum that embraces the standards put forth by the National Council of Teachers of Mathematics (NCTM) — such as *Investigations* in the elementary grades, *Mathematics in Context* or

Connected Mathematics Project for the middle grades, and *Interactive Mathematics Program* in high school — such a curriculum will automatically guide students towards a social justice orientation. In fact, these programs have an unfortunate scarcity of social justice connections. But a strong, conceptually based foundational curriculum can be a great asset to social justice math teaching, because it can encourage students to critique answers, question assumptions, and justify reasoning. These are all important dispositions toward knowledge that teachers can integrate into their social justice pedagogy.

Occasionally, a teacher needs to defend this kind of curriculum to supervisors, colleagues, or parents. One approach is to survey your state's math standards (or the national standards) and to find references to “critical thinking” or “problem solving” and use those to explain your curriculum. Also, the NCTM clearly states that “mathematical connections” between curriculum and students' lives are important.

But it's important for teachers to recognize that social justice math is not something to sneak into the cracks of the curriculum. It's not something about which we should feel defensive. What we're talking about here is something that helps students learn rich mathematics, motivates them, and is really what math is all about. A social justice approach to math is the appropriate type of math for these unjust times. Other, traditional forms of math are often too abstract, promote student failure and self-doubt, and, frankly, are immoral in a world as unjust as ours. Traditional math is bad for students and bad for society.

Views on Math and Social Justice

The two of us have been teaching math for a combined total of more than 40 years — one of us in a bilingual fifth-grade classroom in a public elementary school and the other in inner-city public middle schools, in alternative high

schools, and at the college level. Our perspectives on teaching math for social justice have been shaped by our own involvement in movements for social justice during the past three decades — the Civil Rights Movement, anti-war movements, educational justice movements, and other campaigns. We've also been influenced by educators such as the late Brazilian educator

Math has the power to help us understand and potentially change the world.

Paulo Freire, who argued against a “banking approach” to education in which “knowledge” is deposited into the heads of students and in favor of “problem-posing” approaches in which students and teachers together attempt to understand and eventually change their communities and the broader world.

In addition to the benefits outlined at the beginning of this introduction, an important aspect of a social justice approach to teaching math is that it must include opening up the “gates” that have historically kept students of color, women, working-class and low-income students, and students with perceived disabilities out of advanced mathematics tracks and course offerings. The Algebra Project mentioned above, for example, seeks to ensure that “gatekeeper” classes like algebra don't prevent large numbers of historically disenfranchised students from succeeding in higher education. (For information on other such projects, see Resources, page 163.)

Those who wrote for this book, and those who write for the magazine *Rethinking Schools*, are always encouraged not only to explain what they teach and why they try certain things, but to reflect on how they would do things differently next time. In that spirit we recognize that, as white male educators, our experiences have their own limitations and, if we were to do this book

over, we would work harder to increase the representation of authors of color. We encourage all educators who teach math, particularly educators of color, to write about their experiences teaching math for social justice and to consider submitting articles for possible publication in *Rethinking Schools* or online at www.rethinkingschools.org/math, where we share additional teaching ideas, units, and perspectives on teaching math for social justice.

Isn't Math Teaching Neutral?

While reading these articles, some people might question whether it's appropriate to interject social or political issues into mathematics. Shouldn't math teachers and curriculum, they might say, remain "neutral?"

Simply put, teaching math in a neutral manner is not possible. No math teaching — no teaching of any kind, for that matter — is actually "neutral," although some teachers may be unaware of this. As historian Howard Zinn once wrote: "In a world where justice is maldistributed, there is no such thing as a neutral or representative recapitulation of the facts."

For example: Let's say two teachers use word problems to teach double-digit multiplication and problem-solving skills. They each present a problem to their students. The first teacher presents this one:

A group of youth aged 14, 15, and 16 go to the store. Candy bars are on sale for 43¢ each. They buy a total of 12 candy bars. How much do they spend, not including tax?

The second teacher, meanwhile, offers a very different problem:

Factory workers aged 14, 15, and 16 in Honduras make McKids children's clothing for Wal-Mart. Each worker earns 43 cents an hour and works a 14-hour shift each day. How much does each worker make in one day, excluding fees deducted by employers?

While both problems are valid examples of applying multi-digit multiplication, each has more to say as well. The first example has a subtext of consumerism and unhealthy eating habits; the second has an explicit text of global awareness and empathy. Both are political, in that each highlights important social relations.

When teachers fail to include math problems that help students confront important global issues, or when they don't bring out the underlying implications of problems like the first example here, these are political choices, whether the teachers recognize them as such or not. These choices teach students three things:

1. They suggest that politics are not relevant to everyday situations.
2. They cast mathematics as having no role in understanding social injustice and power imbalances.
3. They provide students with no experience using math to make sense of, and try to change, unjust situations.

These all contribute to disempowering students and are objectively political acts, though not necessarily conscious ones.

As high school teacher Larry Steele details in his article "Sweatshop Accounting" (page 53), the seemingly neutral high school accounting curriculum in fact approaches the world in terms of markets and profit-making opportunities. Not everything that counts gets counted, Steele says, and thus the "neutral" curriculum actually reinforces the status quo.

We believe it's time to start counting that which counts. To paraphrase Freida, the ninth grader quoted above, we need to encourage students to defend their rights and to recognize the injustices around them. By counting, analyzing, and acting, we will help students and ourselves better read the world and remake it into a more just place.

Eric (Rico) Gutstein and Bob Peterson
April 2005