"And That's Just How It Starts": Teaching Mathematics and Developing Student Agency

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This article reports on a two-year qualitative, practitioner-research study of teaching and learning for social justice. The site was my middle-school mathematics classroom in a Chicago public school in a Latino/a community. A major pedagogical goal was to create conditions for students to develop agency, a sense of themselves as subjects in the world. My research suggests that students learned mathematics and began to develop sociopolitical awareness and see themselves as possible actors in society through using mathematics to understand social injustices. This research contributes to our understanding of how to create opportunities for students to develop agency in K-12 mathematics classrooms, and may also contribute to our knowledge of developing agency in any subject area.

> 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. . . . I mean, now 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[1], August 2001).

Freida was my mathematics student for almost two years, during her seventh and eighth grades, from 1997 until 1999. A major focus of the class was on teaching and learning mathematics for social justice. When the students were between tenth and eleventh grades (summer, 2001), I

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mailed them an open-ended survey. Freida's response was to the question, "How did your views about mathematics change from being in my class?" The school, Rivera Elementary School, was located in "Morningside," a large, Mexican immigrant community in Chicago. As a university-based mathematics educator, I worked with Rivera for a decade, from 1994 to 2004, which included teaching my own middle-school mathematics class, as a volunteer, for about four years. My goals in terms of mathematics were that students learn the subject, achieve conventional school success, and change their orientation toward mathematics away from a rotely-learned, mechanical process to one that was relevant and meaningful. But I also had goals specifically related to social justice. These were that through the study of mathematics and within mathematics class, students develop sociopolitical consciousness, a sense of social agency, and positive social/cultural identities. (See Gutstein, 2003, 2006b for details.)

Although this work had multiple facets, here I focus on the potential of teaching mathematics to create the conditions for students to develop agency. I situate this possibility within the current sociopolitical context of the U.S. in which poverty and suffering for many are intensifying, particularly for low-income communities of color. I focus on these students who mainly attend urban schools (like in Chicago) in the high-stakes, punitive climate of No Child Left Behind (2001). My goal here is to describe my curriculum and pedagogy and draw theoretical and practical implications from my research to inform the efforts of educators committed to social justice. I begin by outlining my theoretical framework and then discussing the development of student agency. I follow this by situating the development of agency within the current sociopolitical context and conclude by examining the long-term influence of the class.

Will this work for educators at the university level?

THE WORK OF PAULO FREIRE

My pedagogical practice is shaped by major currents within liberatory education. The first is the practice of Paulo Freire (1970/1998). Freire's work, in his native Brazil and in Africa and Latin America, has profoundly impacted both the theory and practice of liberatory education around the globe. Among Freire's central tenets was that education and politics were inseparable and therefore no education could ever be neutral. For him, education should always be linked to broader social movements to serve the struggles for humanity and liberation from oppression.

Much of Freire's writing and practice focused on *emancipatory literacy* (Freire & Macedo, 1987). Freire framed this as *reading the word*—acquiring text literacy—and *reading the world*—developing a sociopolitical, his-

torical understanding of one's own life conditions and broader society. For Freire, these were inextricably connected. However, Freire did not just advocate for understanding one's world, but also for changing it, which he called *writing the world*. He argued for education in which teachers challenged students to reflect on their lives and social realities through a political lens (read the world) and then to engage in efforts to overcome injustice (write the world). To create opportunities for students to acquire literacy and to read and write their worlds, Freire contended that teachers needed to develop *problem-posing pedagogies* that unabashedly serve the oppressed's struggle for liberation—an education that "strives for the *emergence* of consciousness and *critical intervention* in reality" (Freire, 1970/1998, p. 62):

> Problem-posing education, as a humanist and liberating praxis, posits as fundamental that people subjected to domination must fight for their emancipation. . . . Problem-posing education does not and cannot serve the interests of the oppressor. No oppressive order could permit the oppressed to begin to question: Why? (p. 67)

Freire's (1994) view of human agency was that through liberatory education, students would become *subjects* in the world—people who see themselves as historical actors, capable of remaking society. He argued strongly that for students to emerge as subjects, teachers must be open with their views, but must never impose them and instead create space for students to develop their own ideas:

> . . . inasmuch as education of its very nature is directive and political, I must, without ever denying my dream or my utopia before the educands, respect them. To defend a thesis, a position, a preference, with earnestness, defend it rigorously, but passionately, as well, and at the same time to stimulate the contrary discourse, and respect the right to utter that discourse, is the best way to teach, first, the right to have our own ideas, even our duty to "quarrel" for them, for our dreams . . . and second, mutual respect. (p. 78)

As I understand Freire, teachers' roles—predicated on honesty, respect for the lived experiences and culture of students, and a commitment to humanity and emancipation—included educating youth to be conscious actors in social justice movements. However, Freire (1970/1998) knew that teachers could not "name" injustices for students: "No one can, how-

ever, unveil the world *for* another" (p. 150). Rather, this naming had to be done in genuine collaboration: "So it is that the leaders cannot say their word alone; they must say it *with* the people" (p. 159). Freire believed that the struggles—for fundamental social transformation and against oppression—of the oppressed (i.e., marginalized students) and of those whom he referred to as "revolutionary leadership" (critical educators) were ultimately and inseparably linked.

Throughout his life, Freire emphasized the development of student agency as a component of education and of the political struggles for liberation that served each other. He argued that teachers themselves should be involved in social movements and that they should encourage students to do the same. His insistence on *praxis*—the unity of reflection and action—and his focus on learners starting with their own life experiences in reading the world, positioned students as capable of shaping society—writing the world. He espoused that teachers defend their views while creating problem-posing pedagogies and appropriate spaces so that students develop their own viewpoints, critically engage their worlds, transform their consciousness, and participate in their own emancipation. For Freire, that students emerge as politically conscious and active people was fundamental—drawing on his work, this was also a central goal in my mathematics teaching.

AFRICAN AMERICANS AND EDUCATION FOR FREEDOM

Freire's emphasis on agency for both students and teachers was related to how he viewed their co-participation in justice struggles—that there was a basis for genuine solidarity and partnership between critical educators and students. That is, teachers wanting to change the world need to engage students in doing the same. But another educational tradition, predating Freire, also speaks to this solidarity and sense of agency, and that is the historical struggles of African Americans for emancipatory education (Anderson, 1988; Bond, 1934/1966; Payne, 1995; Perry, 1996, 2003; Watkins, 2001; Woodson, 1933/1990). I draw from this tradition as well to frame my work.[2]

No mention of bell hooks. No LGBT, or other marginalized communities.

Perry (1996, 2003) outlined a philosophy of African American education and named it, "education for freedom, racial uplift, citizenship, and leadership" (2003, p. 93). Drawing on narratives and historical record, Perry clarified that throughout slavery and Jim Crow segregation, African American individuals and communities educated for these goals. She described, in language similar to Freire's, how African Americans historically perceived education:

> You pursued learning because this is how you asserted yourself as a free person, how you claimed your humanity. You pursued learning so you could work for the racial uplift, for the liberation of your people. You pursued education so you could prepare yourself to lead your people. (2003, p. 11)

Teachers in African American communities had the clear goals of awakening humanity, developing leadership, and fighting for liberation. This could apply to mathematics as well. For example, the work of Bob Moses and the *Algebra Project* grew out of this tradition and was based in the Mississippi freedom struggles of the Civil Rights movement (Moses & Cobb, 2001). As Watkins (2001) stated, African Americans throughout their history viewed education "always at, or near, the top of the freedom list" (p. 181).

The view that teachers and marginalized students, as activists and subjects, need to partner in a common struggle against oppression and for liberation is thus a central theme in both Freire's writings and in African American education. Though not identical, both Freire's praxis and African American educational struggles teach us that teachers need to create conditions for students to develop sociopolitical awareness and a sense of agency. This orientation towards students was central to my efforts in teaching mathematics. But the reality of contemporary urban U.S. classrooms mocks that goal. Teachers are positioned as enforcers, disciplinarians, and police officers, controlling "unruly," "resistant," and "dangerous" students. Also, high-stakes accountability regimes make it difficult to engage students in problem-posing pedagogies or build on students' lived experiences (Lipman, 2004). However, despite that reality, enacting genuine partnerships to develop agency is possible, to which a wealth of scholarship points (e.g., Christensen, 2000; Darder, 2002; Johnson, 1995; Ladson-Billings, 1994; Peterson, 1991; Shor, 1987). Although there is less research in mathematics education along these veins, the literature is growing (e.g., Brantlinger, 2006; Gutstein & Peterson, 2005; Turner, 2003).

I argue here that youth in K-12 classrooms are more than just students—they are, in fact, actors in the struggle for social justice. If we want a more just future, then we need to do everything in our power to develop students who will join those endeavors as critical, independent, strong, and clear-thinking participants. We need to, like generations of African American freedom teachers, see our own futures in those of our students. And even though the majority of teachers in the U.S. are white, like myself, and thus accrue white privilege, we can stand in opposition to racism and other forms of oppression. We can learn from and adopt

the ethics of African American teachers described by Perry and others. As Vincent Harding (1990) so eloquently reminded us:

> . . . one of the most powerful aspects of our vocation as teachers over this next period [is] to help the entire nation understand that the freedom struggle of its African American citizens has always been a gift of life and truth to the whole society. Always. (p. 108)

In this article, I provide examples of how I taught middle-school mathematics to try and actualize some principles from these liberatory traditions. I do not suggest that my efforts were either exemplary or entirely successful. Rather, one can view them as one attempt among many in which teachers try to provide opportunities for students to read and write their world. The lessons bear examining because mathematics classrooms are rarely the site of such attempts and because overall, we do not know enough about how to create conditions for students to develop a genuine sense of agency.

This work was part of a multi-year research program that colleagues and I conducted in an urban, Latino/a school (Gutstein, 2003; 2006b; Gutstein, Lipman, Hernández, & de los Reyes, 1997). Collectively with teachers and administrators, we studied culturally relevant pedagogy (Ladson-Billings, 1995), education for empowerment, and teaching for social justice. I focus here on my practitioner research; as the classroom teacher, I had full responsibility for teaching, assessment, parent contact, report cards, standardized test preparation, and so on. The data for this article are mainly from the 1997–8 and 1998–9 school years. I started teaching a seventh-grade class in November of 1997 and stayed with that class through their eighth-grade graduation in June 1999 (although I continued to teach at Rivera until January, 2003).

Throughout this article, I interweave data and analysis and use students' own words at length because what they said conveys their meanings in ways that my interpretations cannot capture (Weis & Fine, 1996). Although this article is about a mathematics class, I also consider issues that go beyond mathematics because, as Freire (1994) said, we do not *just* teach mathematics in a mathematics class. Furthermore, although I situate my work within both Freire's philosophy and African American educational praxis, they play different roles—both provide an orientation towards students that I embrace, but I also use Freirean theory to analyze and make sense of my pedagogical practice.

METHODOLOGY

While teaching at Rivera, I used *Mathematics in Context* (MiC) (NCRMSE & FI, 1997–8) as my primary curriculum. I taught MiC about 75–80 percent of the time. MiC is based on the reform mathematics recommendations of the National Council of Teachers of Mathematics (NCTM, 2000). Its philosophy entails that students should construct their own knowledge and "reinvent significant mathematics," and it supports and values multiple strategies. Students are often in the position of being arbitrators of knowledge and have to explain the thinking behind their mathematical decisions. The curriculum is grounded in the idea of mathematics as a human production, and thus virtually all of its contexts are real-life situations. In many ways, although it is not oriented toward sociopolitical consciousness or agency, the dispositions toward knowledge that it engenders can, under certain conditions, support their development.

However, beyond learning mathematics, I wanted students to learn to read and write the world with mathematics. Therefore, I developed a series of "real-world" mathematics projects in which students investigated racism and other injustices using mathematics as a key analytical tool—unlike the MiC contexts that were all ostensibly neutral. These projects were a central component of my classroom and each one took from two days to over two weeks to complete. Over almost two years, my class worked on 17 real-world projects (Gutstein, 2001b). A central component was that the students and I co-created a classroom climate supporting social justice pedagogy. I refer to this as *normalizing politically taboo topics*. For further details on the interconnections of MiC and teaching mathematics for social justice, see Gutstein (2003, 2006b).

Rivera is a K-8, neighborhood school of 800 students, 99 percent of whom are Latino/a, the vast majority Mexican, and 98-99 percent are low-income. Students are mainly immigrants or first generation in the U.S., and almost all speak Spanish, although to differing degrees of fluency. There are regular and honors tracks and a bilingual program (I taught in all), but honors-track students are demographically indistinguishable from regular-track students. At grades 6–8, classes are departmentalized, and standardized tests are a major concern. Parents established a uniform policy to instill pride in the school, reduce economic pressures, and claim the school as neutral territory with respect to gangs. Most Rivera graduates attend the neighborhood high school with a dropout rate of over 50 percent. Virtually all students live in Morningside except for some honors-track students who live in nearby, low-income, Latino/a neighborhoods.

My seventh-grade class in 1997–98 had 26 students and was in the honors-track, bilingual program. In 1998–99, in eighth grade, two students replaced two others who left Rivera. All 28 were from Latino/a, immigrant, working-class families (only one family was barely over the "poverty" level), and except for one from the Dominican Republic and one from Puerto Rico, all were of Mexican heritage. Spanish was the first language of all my students, and all but one were fluently bilingual in Spanish and English.

This was practitioner research (Anderson, Herr, & Nihlen, 1994), and I used semi-ethnographic methods including participant-observation, open-ended surveys, and textual analysis of documents (Hammersley & Atkinson, 1983). My data include students' mathematics work and scores from standardized and high school admission tests. I maintained a practitioner journal in which I recorded reflections and observations on classroom climate and culture, students' mathematical work, their dispositions, my personal interactions with them and their families, and classroom discussions around various topics. I collected 41 sets of weekly journal assignments that included students' reflections on their mathematical learning and about issues we were studying or discussing.

In addition, I also collected 16 of the 17 real-world projects including mathematics and written work which ranged from answering open-ended questions to writing a full essay; these dealt with students' views, interpretations, and feelings on the particular issue. I also administered three anonymous surveys on attitudes and dispositions toward mathematics and on the class as a whole. My informal conversations over ten years of work with Rivera, with students, parents, and community members, both in and out of school, inform my analysis. As of this writing (October 2006), many are college seniors, and I maintain contact with several. We continue to reflect on and learn from ongoing conversations about the class and its influence on their lives.

I triangulated the data from the multiple sources.[3] After I left the classroom, I analyzed the data using open and focused coding (Emerson, Fretz, & Shaw, 1995) and iteratively looked for patterns and relationships that emerged and which guided further analysis. Throughout my teaching and analysis, I was conscious that I was a white male professional in an unequal power relationship with students and their families, including having the power to grade, make high school recommendations, and discipline students while teaching. It was possible that students, in their journals, other writing, and speaking, wrote and said things that they thought I wanted to hear. I attempted to minimize this issue by explicitly trying to create space for multiple perspectives and decoupling grades from stu-

dents' writings, but nonetheless, students' views may have been influenced by our relationship.

DEVELOPING AGENCY THROUGH READING THE WORLD WITH MATHEMATICS

Although I do not have space to discuss them, there are many challenges to developing student agency. These include what Macedo (1994) called *literacy for stupidification*, what Freire (1970/1998) referred to as *banking* education and internalized oppression (King & Wilson, 1994; Woodson, 1933/1990), the pacification of multicultural education (May, 1999), and high-stakes testing and accountability regimes (Lipman, 2004). In addition, my students sometimes exhibited a sense of powerless when confronted with injustices with which they were not familiar, such as the unequal distribution of wealth in the world and the U.S.

These challenges raise serious questions for progressive teachers (Bigelow, 2002): How do we introduce students to severe realities beyond their immediate experiences—which may be already harsh—without paralyzing them into inactivity? How can we invigorate, enthuse, and motivate students to fight for social justice given the admittedly depressing state of the world? In short, given the objective nature of both schooling and the current sociopolitical climate in which we live, what is a pedagogy of hope and how do we encourage the development of students' sense of agency?

WILL DEVELOPMENT BURRY THE BARRIO?

The first real-world project I gave my class as seventh graders (December, 1997) was about the school neighborhood. The essence of the project was for students to use mathematics to begin to understand the dynamics of gentrification because real-estate developers coveted Morningside due to its proximity to downtown. A developer wanted city permission to pave over a tiny park for secured parking for condos he was developing just at Morningside's edge. Students read about the plan in a newspaper article and located the park on a map. They then computed how long it would take to drive from the park to the Sears Tower in downtown Chicago, at 25 mph, with no red lights. This was mathematically difficult because they had to use two maps with different scales and had to accurately measure on the maps, plan a driving route, convert the fractional distances to miles, and finally determine the travel time given the driving speed—all without specific instructions on how to do each part. As seventh graders in an insular barrio, few students regularly went downtown

and had little concrete idea of how close they really were. When they discovered the travel time—about five minutes—they were shocked.

But despite their astonishment, most students at first did not understand that the closeness to downtown—which they had discovered mathematically—was a prime reason for the oncoming gentrification. At the project's end, I asked students to write an essay arguing for or against the city's granting permission. Most argued against it—but *not* because of ensuing gentrification. Instead, their main argument was for green space, as the neighborhood is densely populated with few parks. Their arguments made sense from their viewpoints but, as one might expect, were not contextualized within Chicago's larger development plans. However, this project put neighborhood gentrification on the table and established the usefulness of mathematics as a tool with which to understand meaningful social realities. As students were reading the mathematical *word*, they began learning how to read the *world* using mathematics.

In June 1998, at the end of seventh grade, we did our last real-world project of the year, the second about gentrification. Students read an extended article titled *Will Development Bury the Barrio?* This article was about a hotly contested development scheme just outside of Morningside. The article reported that developers and city officials promised jobs for Morningside, and the large, proposed housing development would set aside 20% of its housing as "affordable." On the project, students mathematically analyzed percent increases over time of various properties (extrapolating into the future) and how many new community jobs would be created given the various proposals. They also computed weighted averages, as the article listed the development's supposedly average prices, and also the low ($125,000, i.e., "affordable") and high ($350,000) prices. (However, by May 2005, the low price was $289,000, while the high was over $1.1 million!)

The project included the following questions (answers follow in brackets):

> #5) To buy a $125,000 house, the article says that a family of four would need to make $47,000 a year, which is 80% of the median income in the metropolitan area. So how much is the median income in the metropolitan area for a family of four? [$58,750]
>
> #6) Using the information of needing an income of $47,000 to buy a house costing $125,000, how much would a family need to make to buy a house costing $350,000? [$131,600]
>
> #7) According to the article, the median family income for a fam-

> ily of four in Morningside is $22,000 a year. How expensive a house could that family afford? [$58,510]

The final problem was as follows:

> #9) Write a 1–2 page paper that explains your view about the development in Morningside. Do you think development will "bury the barrio?" Why or why not? Use information from the article and from other sources (parents, teachers, the media, etc.) to support your views. This needs to be a well-written essay! What do you think should be done and what do you think you, as a young person, can do about it?

Thus, students used mathematics to understand many complicated issues: whether development would benefit or harm the community, how many jobs would be created, what would and would not be affordable, and what were the trade-offs (e.g., since property values were rapidly rising, home owners could sell for a large profit and move—but what would be the effect on the community?). Mathematics became the entry point for students to analyze the complexities of a serious community issue.

Problematizing students' social realities within mathematics class provided opportunities to learn mathematics—read the word—and deepen sociopolitical understanding—read the world—at the same time. For example, question #7 (what house price could an average Morningside family afford) required mathematics, but the solution clarified that very few Rivera families could afford even the cheapest new houses. This point was not lost on the students who realized that the mathematical term "affordable" was relative, had political meaning in this context, and did not apply to them.

But we did not stop there. I also brought students to City Hall hearings on the plan. Before we went, the class discussed the pros and cons of the issues. Many students talked to their parents and brought their views into class. Despite major opposition within the community to the development scheme, there was also some support, primarily from some local business interests and the area's alderperson (a close ally of the Mayor). The majority of students opposed the development plans, but they were not against development per se. As Marisol wrote:

> I think that it would be great to make our Morningside streets better. Fix the potholes, the sidewalks, plant more trees, repaint some houses, etc., etc. But what I don't agree is that we will only beautify Morningside with the TIF [the city's development plan].

Other students who appreciated the issue's complexity echoed this perspective. Jaime wrote, "Although I'm not with the development, there are some good things coming out from it. Houses are being replaced with new ones and sidewalks are being fixed." But whatever their view on development, no student wanted the demise of the neighborhood. Morningside is a large Mexican community and has symbolic and material significance as a center of Mexican life in Chicago. Thus, students were understandably invested in this project.

An interesting event occurred at the first hearing we attended. As I sat next to a student, Lupe, listening to community members give their three-minute speeches, she asked me if I was going to speak. I had not planned to and told her so. However, she persisted and told me I had to speak. After all, she said, we did not come all the way down to City Hall just to listen—we had to do something. She did not relent, so I gathered myself together, made some quick notes, stood in line, and did my three minutes as well. In retrospect, I am reminded of Freire's (1970/1998) words: "Students, as they are increasingly posed with problems related to themselves in the world and with the world, will feel increasingly challenged and obliged to respond to that challenge" (p. 62). Lupe, though only a seventh grader and not yet ready herself to make a public statement, *wrote* the world in this situation by making sure that her teacher responded and acted as a "political militant" (Freire, 1998).

The essays students wrote were powerful and passionate, whether or not they believed that development would "bury the barrio." Of the 20 students who wrote essays, 13 took the position that something could be done to save the community. There were students like Juanita who wrote, "....All I can think of right now to do is protest and get a better education to get a better job. If you're in politics or have a higher status, then you might have a better chance of saving the barrio." Others were more militant, like Paulina:

> ....Yes, I kind of think that the development will bury the barrio because many residents from Morningside can't afford to pay more rent so they will end up in the streets, but it won't bury the barrio if we keep struggling. There is lots of support to what I said. In the meetings [City Hall hearings] we went to there was no support for this development. Everyone was against it except the people who were not really clear on what will happen to them . . . Not much can be done as a young person because older people don't seem to take us seriously. Why? Well because they think we don't understand what is going on, BUT WE DO! The most we could do is speak out to the community, especially those who

> are not informed about this development. In conclusion, the more people that protest, the easier it will be to win.

But other students felt powerless. Omar wrote, "Then I think of how many people will have to move out of Morningside. And I think of that saying, 'life is not fair.' And it gets to me how true that saying really is." And Danny expressed this as well, partly in response to my report about a demonstration I attended at the mayor's office:

> ....I don't know what I, as a young person, can do to stop this. Attending meetings no longer seems to be an option. You said yourself on Monday that the protests at City Hall were a "last-ditch effort." What else is there to do but wait? I certainly don't know. The saddest thing is that when I one day return to my hometown, it will have gone down in history. Right up there with the lost continent of Atlantis will be the lost Barrio of Morningside.

In fact, given the power of the city's development machine, there were real reasons to be pessimistic. Morningside had held out as long as any community near downtown, and its activists were known for their determination and organizing ability—but the handwriting was on the wall. However, that did not stop many of the students from wanting to attend hearings, go on demonstrations, spread the word, and do whatever they could as still-very-young seventh graders. Freida's essay conveyed that spirit well:

> They think that only because some of us, the Latinos, may have low-paying jobs and may not know English, we don't have a voice. Justice is in one language, not in many. If we don't strive for our rights, they will take over us and even the whole world. If people don't get together to fight this, they would all get overthrown. But I know we have a voice, we have a spirit, we have a goal, and even if we suffer consequences, we will fight and get what we want. Will we let development bury our pride, our family and our liberty? NO! NO! NO!
>
> We are humans and have the strength or even more, the power to get what we want. We may not have high places in government, but with unity and hope, anything can be done. So why should we let them bury us? We know the laws more than them.

> We believe in justice, in freedom of speech, and especially that all men are created equal.

Using mathematics to study one's own community was central to beginning to develop sociopolitical consciousness and agency. However, what made these projects particularly effective was the explicit link to the ongoing social movement to save Morningside. The opportunity to talk with parents and neighbors and share mathematical analyses, and to actually participate in the struggle, at whatever level, was integral to the process. Those students who did not go to hearings or rallies could still take part vicariously because those who did shared their experiences. It was through mathematics that students understood that few neighborhood families could afford even the cheapest houses and that rising property taxes would force landlords to raise rents and long-time owners to possibly move. Mathematical analyses also helped students see how many jobs would supposedly be created, and they argued about whether that benefit offset the forced relocation of fixed- and low-income residents. But the larger political context allowed students to see themselves and others in motion trying to effect social change. The two aspects together—using mathematics to understand the social situation and linking their analyses to the larger struggle—were central conditions for students to begin to develop a sense of agency. In the context of a middle-school mathematics class, this mathematical understanding served as a form of "reflection," while students' involvement and connection to political movements was "action"—it is precisely the dialectical relationship of these two ideas that characterizes Freire's notion of praxis and creates the basis to read and write the world.

SEEING THE WORLD: THE POLITICS OF MAP PROJECTIONS

Freire (1970/1998) wrote "The starting point for organizing the program content of education or political action must be the present, existential, concrete situation, reflecting the aspirations of the people" (p. 76). This suggests that curriculum should start from students' lives and knowledge, such as in the neighborhood gentrification projects. However, it does not necessarily mean that students can only learn to read and write the world by investigating their direct experiences. The "present, existential, concrete situation[s]" that reflect students' "aspirations" can also be ones outside their immediate lives; that is, there are various ways teachers can create opportunities for students to develop agency.

In one of the last projects we did as eighth graders, in May 1999, students analyzed different world map projections (Gutstein, 2001a, 2006b). The goal was to use mathematics to investigate map projections and discover how various representations conveyed different views about the globe (privileging certain areas), and thus examine and develop the power to critique the politics and sources of knowledge. The maps we analyzed were the Peters projection map, an equal-area projection created in 1974 that elongates land masses, and the Mercator projection map (that Gerard Mercator who was born in Flanders, now Belgium, made in 1569) that allowed for accurate navigation but distorts land mass sizes as one moves away from the equator (and that was present in almost all Rivera classrooms). In addition, most Mercator maps push the equator down so that the northern hemisphere takes up about 65 percent of the map, shrinking the south in the process (but pushing the equator down centers Belgium in the map). Mercator made his map not to accurately represent the world, but to aid in colonial exploration and exploitation.

Using Mexico's area as a standard unit of measure, students estimated and compared the areas of pairs of land masses on the Mercator map—Mexico and Alaska, Greenland and Africa, and Scandinavia and India. After finding the areas using a variety of invented, innovative mathematical methods (Gutstein, 2006b), they looked up the actual areas in their almanacs. They discovered that what they saw on the Mercator map (Alaska appears two to three times larger than Mexico, and Greenland and Africa are roughly comparable) was not the reality (Mexico is slightly bigger than Alaska, and Africa is about 14 times larger than Greenland). Even though we discussed Mercator's purpose, students were shocked, angered, and disappointed, and many felt tricked. They had been in school for nine years and had always accepted the Mercator projection at face value. And although we considered that all two-dimensional maps of our three-dimensional planet had to have distortions, many posed the question: "What else have we been lied to about?" For some, like Lupe, this led to a position of advocacy:

> I think it's sad that we've all been taught this way. We should make our analysis public and let it be known. I just want to understand what is the point exactly of Mercator's map. What did he want us to believe, to see?

Paulina added, "I would like to know why someone hasn't come up with a more accurate map? Why don't people stand up and fight to change the map to a more accurate one?"

Other students voiced questions about their past education and wondered about what they had learned. Ricardo wrote:

> By knowing we were all raised on the Mercator map, it makes me feel insecure of what other wrong things we have been taught. Since this map was wrong, we probably have been taught more wrong things in Social Studies and in other academics taught in school since childhood. . . . The questions left in my mind are why would they want to teach us students the wrong information? Why don't they just tell/teach us the truth? That's what I would like to know, if anyone can answer that question, I would be glad.

Alejandra added, "I feel that we didn't get the right info and that we were tricked [into] thinking some countries were bigger than others when it wasn't even true. And this makes me think what else are they lying to us about?" And in a particularly cogent analysis, Sandra wrote:

> Doing this project has opened my eyes in different ways. I am learning how small details like maps, etc., have to do a lot with racism and power. Even though these kinds of things are small it can make a big difference on a person's view after learning what's really [going] on.

Finally, Armando summed up the feelings of many students and implicitly linked the project to other ideas we had studied over the two years: "The new [Peters] map is like the rebellious Chicanos and African Americans. It is showing the world a reflection of its true perception."

When students start to raise questions like this and interrogate sources of knowledge, they begin to view themselves as capable of finding out on their own if the knowledge they have "received" is accurate. They start becoming critical subjects who can eventually participate in the processes of change. This idea is captured well by a farmer in liberated, post-colonial Guinea-Bissau who told Freire, "Before [liberation], we did not know that we knew. Now we know that we knew. Because we today know that we knew, we can know even more" (Freire & Macedo, 1987, p. 114). Analyzing the maps and the political knowledge they represented was an opportunity for students to "reach a 'perception of their previous perception.' By achieving this awareness, they come to perceive reality differently . . . [and] discover more easily in their 'background awareness' the dialectical relations between the two dimensions of reality" (Freire, 1970/1998, p. 96). This "discover[y]" and the juxtaposition of students'

prior understandings to their creation of new knowledge contributed to their sense of agency. They began to appreciate their own capacity to deconstruct representations, using mathematics, and thus further developed their own conceptions of reality, knowledge, power, and politics. Doing so can create in students the belief that they can effect change. Lupe's words capture the essence of this sense of power:

> This [project] relates to not just accepting what we have but to search for answers to our questions. You have taught us to do that in many ways, and that only makes us grow. Who knows? Maybe we can someday prove things wrong and show the right way!

REFLECTIONS

As one would expect, my students varied in their responses, and some at times exhibited ambivalence and vacillation. For instance, when I asked if students had any questions about the map project, Rosa wrote, "The questions raised in my mind are why teachers never told us how wrong the map was." But when I asked if the map projection was ". . . in any way connected to anything else we've studied over the last two years," Rosa wrote, "I don't think it is connected to anything else. Because like I said I believe they didn't do it on purpose. If I didn't think this way I would say it's connected to wealth distribution." (In one project, we simulated the wealth of different continents using cookies, and we later did the same for different income strata within the United States.) Thus, on the one hand, she denied that the map project was connected to anything we had studied, and on the other hand, acknowledged that *if* it were connected, it would be to unfair wealth distribution.

In reflecting on the map project, I became aware of some weaknesses and more fully appreciated the difficulty of actualizing Freire's (1994) admonishment to critical teachers—"To defend a thesis, a position, a preference, with earnestness, defend it rigorously, but passionately, as well, and at the same time to stimulate the contrary discourse . . ." (p. 78). I did not provide sufficient context for students to grasp that the real issue was not that the Mercator map was less accurate than the Peters. In one sense it is, because while the Peters map alters shapes, it does not alter the relative sizes of different countries—that is, a country that is bigger than another appears as such. But since all world maps cause distortion, I believe the real issue is that the choice of *which* distortion to use is ultimately political (Frankenstein, 1998). The Peters map is a post-colonial map specifically designed to fairly represent the peoples of the world. Thus, its purpose is explicitly political, but also its very existence is

intended to argue that *all* maps are political, including Mercator's. By not thoroughly discussing these issues with students, I failed to fully "stimulate the contrary discourse." This mistake was a learning opportunity for me. Teaching for social justice is not simple, but as Freire (1994) wrote, "Is there risk of influencing students? It is impossible to live, let alone exist, without risks. The important thing is to prepare ourselves to be able to run them well" (p. 79). Yet even with these complexities, my data overall suggest that I was able to provide sufficient space for students to challenge and critique (including me, as I discuss in Gutstein, 2006b).

My research suggests that one starting point for developing agency is to teach students how to use analytical tools—like mathematics—to learn about social realities so that they can begin to understand for themselves contradictions in what they have learned. The map project gave students the chance to use mathematics to analyze their prior teachings, examine the positions embodied in the competing perspectives, and reflect on the politics of knowledge.

Virtually every student critiqued, or at least questioned, what they thought they knew during the map project. Even Antonio, a student who often rationalized—for example, he wrote, "This [Mercator] map is pretty old, isn't it? Maybe it was never really updated with new area"—summed up the situation: "I feel that using a map that doesn't display the world correctly is just wrong. A country with a smaller area cannot be bigger than a country with a larger area."

My research also suggests, however, that another component of developing agency was to start from students' lives and link their (mathematical) knowledge production with their participation, even if tangential, to larger social movements affecting them. The gentrification projects provided such opportunities. Both types of projects contributed to their sense of agency because what they (and all the real-world projects) had in common was that they made "oppression and its causes objects of reflection" (Freire, 1970/1998, p. 30). In classrooms in which students and teacher co-create a community that normalizes investigations of such phenomena using disciplinary knowledge, these experiences may be powerful ways for students to become subjects, in a Freirean sense.

DEVELOPING STUDENT AGENCY IN THE CURRENT SOCIOPOLITICAL CONTEXT

I argue that we can (and should) draw from the legacy of both Freire's pedagogy of the oppressed and African Americans' struggles for "education for freedom, racial uplift, citizenship, and leadership" (Perry, 2003, p. 93). We can take from them an orientation toward students that sees

them as conscious subjects in the struggles for humanity and liberation, and that creates conditions for students to become agents of change toward social justice. This view implies that we see ourselves, as educators, with the responsibility to provide students opportunities to develop agency.

It is important to declare that teachers are not powerless, even within repressive educational systems (Carlson, 2002) and the current political climate (Apple, 2001). While we cannot always directly or immediately affect macro political and economic structures, although that is an essential part of creating a more just society, we do have agency ourselves. The *Rethinking Schools* publications (e.g., Bigelow & Peterson, 2002) provide specific examples of classroom practices oriented towards social justice. My perspective here includes, but looks beyond, the efforts of teachers, administrators, families, and community members in rectifying inequities and sees students themselves as key participants in the struggles for equity and justice. To do so, they need the tools to enable them to play that transformative role—and among these is a sense of agency.

My students were engaged in reading the world using mathematics for several reasons. As honors-track students, they were well socialized by their schooling experiences to take themselves seriously as learners and usually worked in partnership with me as their teacher. Students that I taught in Rivera's general program also completed real-world projects and developed aspects of mathematical power (Gutstein, 2006a), however, not to the extent of students in the honors-track program. I analyze the complicated reasons in Gutstein, 2006b.

The content of the projects generally tapped into the students' experiences and knowledge, the justice issues resonated with their own values, and the mathematics was academically challenging and engaging in various ways. It is significant that students achieved conventional academic success while learning mathematics in a classroom with a social justice focus combined with an NCTM-aligned curriculum. They all passed my classes; graduated eighth grade; gained, on average, 1.0 year from their May 1998 ITBS test to the May 1999 test; and 15 of the 18 who tested for magnet high schools were accepted (half of the test is on mathematics). As of this writing, many are in their senior year in colleges ranging from community colleges to three in top-ranked private universities. Their mathematics work has varied. Some did quite well in high school mathematics, including being on the city-wide mathematics team, while others struggled with the transition back to traditional, "skills and drill" math. I attribute most of their mathematics learning to their primary curriculum, MiC, but I do not discount the role of the real-world projects.

It is also significant, however, that working-class, bilingual Latino/a stu-

dents from immigrant families developed aspects of "mathematical power"[4] *and* began to develop sociopolitical consciousness and agency. In fact, it is precisely and especially these students who are usually taught neither "the knowledge, skills, and attitude needed to struggle successfully against oppression," nor "excellent skills from the basics of reading, writing, and math, to understanding history, thinking critically, solving problems, and making decisions" (Ladson-Billings, 1994, pp. 139–140). Overall, Latino/a students drop out at greater rates than all other ethnic groups except Native Americans (National Center for Educational Statistics, 2003). In 2002, the graduating class in Rivera's neighborhood high school was about 260 students, but as freshmen in 1998, that class had over 550 students. Rather than being immersed in world-class curricula designed to ensure they have the cultural and social capital and knowledge to be leaders in society, Latino/a students are generally the "recipients" of basic-skill, low-level mathematics curricula (Secada, 1992) that may prepare them best for low-paid, service-sector jobs in a globalized and polarized economy (Lipman, 2004).

In the current political and educational situation in the U.S., district, state, and federal mandates of accountability, supervision, and regulation, as exemplified and crystallized in the No Child Left Behind Act (2001), are exacerbating this situation. A prime example is the January 2003 decision by New York City to mandate reading, writing, and mathematics curricula for over 80 percent of its public schools, while allowing 208 of the highest-scoring schools to choose their own. As Schools Chancellor Klein stated, "Schools exempted from the new curriculum have shown they are doing work that is achieving results in reading, writing, and math" (New York City Department of Education, 2003a). The vast majority of the free-to-choose schools were in more middle-class communities with less students of color, and conversely, the overwhelming majority of mandated-curriculum schools were in low-income communities of color (Hoff, 2003). Although the stated rationale of the initiative was to "provide New York City's 1.1 million schoolchildren with the quality education they need and deserve" (New York City Department of Education, 2003b), schools within richer, whiter communities had the option to educate their students for leadership in the ways they saw fit, while poorer, Blacker or Browner schools had to focus on "achievement" as determined by city and state test results. Thus, the institutional power of the state mandates and reinforces stratified and segmented educational trajectories.

The pressures of high-stakes testing and accompanying policies of retention, promotion, and probation, however, do more than just "dumb down" education with low-level (mathematics) curricula and prepare the

bulk of Latino/a students for serving others. More than that, they deny students the opportunity to develop the tools of critical citizenship with which to challenge inequities and instead intensify the process of "education for stupidification" (Macedo, 1994). These policies stymie teachers' attempts to teach for social justice and ensure that students are "equipped to struggle against racism" (Ladson-Billings, 1994, p. 140). Teachers' attempts to use students' culture and language are curtailed, as bilingual education programs are gutted (as in California) or become "education for assimilation" (Lipman & Gutstein, 2004). Incessant standardized test preparation eats up time, interfering with the opportunities for teachers to use liberatory pedagogies and curricula, but it also creates ideological conditions that support unitary "correct" answers residing outside of students' knowledge and lives. In this way, the policies and tests teach students that they neither create nor arbitrate knowledge. In addition, the impact on students is both material—they fail, drop out, are retained—and ideological—they blame themselves for failure, which can also lead to dropping out (Lipman & Gutstein, 2004). And these particular students—low-income students of color—are not only the ones most disproportionately affected by punitive policies (Lipman, 2002) and most likely to drop out, they also have the potential to play key leadership roles in the struggles for justice now and as they grow into adulthood (Harding, 1990). To deny them the opportunities to develop the knowledge and dispositions with which to analyze, critique, and change the conditions of their lives and of society as a whole is to maintain, reproduce, and extend injustice and inequality.

Thus, the very time when such policies and consequences are intensifying is the time when teachers need to escalate their attempts to teach mathematics (and other subjects) for social justice and create conditions for students to develop agency. And it is possible to do so, despite the difficult challenges in teaching mathematics this way. Frankenstein's (1983, 1990, 1995, 1997, 1998) long-term work with adults provided evidence (at least at the college level) that one can teach mathematics so that students better understand some of the complexities in our society—and learn mathematics. She provided examples of what teaching mathematics for social justice looks like (for example, by having students analyze military versus domestic expenditures to better understand and critique fiscal priorities within society) and demonstrated how it is possible for students to transform their awareness of society through mathematics classes. However, she realistically cautioned that students do not gain this awareness in linear ways, and it may be difficult to sustain: "It may be that the most critical collective change that a pedagogy of the oppressed can

bring about in our circumstances is a subtle shift in climate which will aid the progress of liberatory social change" (Frankenstein, 1983, pp. 335–6).

EXAMING THE LONG-TERM INFLUENCE OF DEVELOPING AGENCY

Despite the limited research documenting teaching mathematics and developing agency in K-12 schools, the literature is growing (e.g., Gutstein & Peterson, 2005; Tate, 1995; Turner, 2003). Although there is some evidence that my students began to develop agency, the questions remain: Does such a class influence students over time to become agents of change? What difference does, and will, it make in the long run? How does it impact upon the struggles for social justice in the world? And how can we know?

Clearly, these are not simple nor easily answerable questions. I do not mean to suggest that one can infer direct causal relationships, for life is far too complicated. Furthermore, school experiences may have little to do with students' out-of-school life choices. To address these questions, four of the students and I have studied the influence of the class (Gutstein, Barbosa, Calderón, Murillo, & Nevárez, 2003). Our perspective was essentially reflective introspection and critical dialogue.[5] The four students have considered their own growth and choices and the relationship of these to their seventh- and eighth-grade mathematics experiences. While we did not attempt to reach definitive conclusions, they suggested that these educational experiences were important to their development. For example, Nevárez commented:

> I don't have to depend on anyone else to explain anything to me, I can think for myself. No one has to feed anything to me. I don't have to just take whatever is given to me, and, you know, repeat it or whatever. I can think for myself. And, that's gonna help me by far, and I feel that I am just so ready to get out there, and do what I have to do with my life (January, 2003).

And another student, Calderón, commented:

> . . . before that class . . . I knew about certain historical moments and certain things, but I never really acted on any of them. I didn't really share my ideas with anyone. This classroom really opened it up for me, and this is when I really started to get involved. I started talking to other people, and finding their

> opinions. And it wasn't just, I'm gonna take what this book tells me and that's the answer. I'm starting to take facts now and making my own decisions. I didn't realize that before seventh and eighth [grades], that you had to make up your own mind, I just figured, oh, people memorize this, people memorize that. (January, 2003)

I leave readers with two brief stories that are suggestive of change, that speak to the possibilities of agency rather than powerlessness. I do not claim that these students are necessarily representative of all 28, or that these vignettes should be read to imply definitive changes in students' lives. Nor do I wish to imply that these actions are directly attributable to our class. Yet their actions, along with their self definitions, suggest that these students were beginning the process of developing agency. In Freire's (1970/1998) terms, "The conviction of the oppressed that they must fight for their liberation is not a gift bestowed by the revolutionary leadership, but the result of their own *conscientização* [sociopolitical consciousness]" (pp. 48–9).

Calderón was a high school senior in the 2002–3 school year. He and I taped a conversation in preparation for a presentation. He described how his social studies teacher ended class with five-minute "shoutouts" in which students could raise any issue they wanted (they submitted an anonymous note to the teacher). Seeing a Mercator map in his classroom, Calderón took some educative action.

> Calderón: I asked, "what's wrong with the map in the back of the room?" And they were all like, "What are you talking about?" And the teacher was kind of like, "What? What is this?" And I just kind of stayed there quiet for a while, because I realized just how big a reaction everyone had, they were like, "Huh?". , . . I said, "Well, there are a lot of things wrong with the map," and I explained to them.
>
> Gutstein: Did you go up to the map?
>
> Calderón: Yeah, I went up to the map and I talked about the south and the north, and I compared Alaska and Mexico, Greenland, and Africa and Asia, and how Africa is this really big continent and how it's represented on the map, and a couple of the students were like, "Whaa?" They didn't understand it. . . . But, the teacher was kind of surprised. She was like, "Oh wow, I didn't even know that!" And she was really interested. And a cou-

> ple of other students were kinda "Oh, I didn't know that." They got really into it, too. And ever since then, I would put out shout outs about different things, and people would be like "Oh, that has to be Adrian's."
>
> Gutstein: And so, how does that relate to this issue of, "Oh well what can we do about it?"
>
> Calderón: It proves that not everyone thinks like that. It's just a matter of does one person—is one person gonna make a difference. I made a difference! Like, 7 people, it was 28 people, 7 people out of 28 people, now they realize that, "Hey maybe I should take a second look at the map." *And that's just how it starts* [italics added].

The second story is about how several students in the class took a stand. During the 2002–03 school year, while I was teaching at Rivera, the principal who had so strongly supported my work moved on. A district-appointed temporary replacement did not like the politics of the real-world projects and forced me to leave at the end of the first semester. A meeting about my situation was held at the school, attended by about 150 people—25 of my then and former students, many of their parents, and other parents and community members. (A struggle to reinstate me transformed, appropriately in my view, into a struggle to remove the temporary principal; the community eventually won, through many twists and turns, and I returned to work with Rivera.) At the meeting, several of my former students (and their parents) spoke out strongly in support of what they had learned and why it was important. Although one can expect expressions of student loyalty to caring teachers in such a situation, what was significant was that students (and their parents, Gutstein, 2006c) overwhelmingly voiced support of a curriculum in which students learned mathematics and used it to investigate injustice. My former students from this class (high school seniors at the time) organized themselves and wrote a collective letter signed by 17 of them (all they could reach on a few days' notice) that one read to start the meeting. In the first paragraph, they wrote, "We are addressing this matter because we believe this act was an injustice to the school and the students in Mr. Rico's [my classroom name] math class." The letter also states:

> By being his 7th and 8th grade math students at Rivera five years ago, we feel that his way of teaching was essential to our development not only as mathematics students, but also as human

> beings. His integration of real-life issues into the math projects he assigned to us was an effective way of exercising our ability to think critically about the world we live in *and to the way we respond to it* [italics added].

I had hoped that students would develop a sense of agency, that they would stand up and speak out for what they believed in. I just never expected that it would be on my behalf.

Thus, a compelling piece of evidence that these students began to develop a sense of agency may be the events that brought them to speak out on behalf of the very school experiences years earlier that contributed to their development. Coupled with their rich and varied life experiences and knowledge over their lifetimes, and their powerful sense of justice derived from their positions in society and their critical analyses of the world, their middle-school mathematics class in which they began to read the world using mathematics may have provided contexts, tools, and space for them to begin and/or continue the complex processes of developing agency. It is important to clarify and name the contributing factors in students' growth, when we can. Given the empirical evidence and the (admittedly problematic nature of) self-reflections/self-reporting on the part of the students, there is enough justification to warrant a provisional claim: teaching mathematics for social justice in urban, public schools—in which developing agency is a central part—*can* make a difference in students' lives beyond the classroom. The complexities are many, the paths manifold and not always certain, and the constraints and challenges real. But the possibilities exist to stand on the shoulders, and learn the lessons, of the diverse educators, here and abroad, who have been on this road for a long time. As Calderón declared, "*And that's just how it starts.*"

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Notes

1 All proper names in this article are pseudonyms unless otherwise specified.

2 I draw on African American education traditions because they are well known and

extensively documented. However, I am not suggesting that others lack such a history. For example, Mexicans and Chicanos within the U.S. long fought for education as part of a larger emancipatory project (e.g., Acuña, 1996; Delgado Bernal, 2000; Donato, 1997; Getz, 1997; Guajardo & Guajardo, 2004; Gutiérrez, 2004; Ruiz & Racho, 1996).

3 I compared my observations of students' work and attitudes in the classroom; their mathematical work and writings on the real-world projects; and students' own reports as manifested in their journals, my conversations with them, and the surveys I conducted.

4 I use the vision of mathematical power from the NCTM (2000): "Students confidently engage in complex mathematical tasks . . . draw on knowledge from a wide variety of mathematical topics, sometimes approaching the same problem from different mathematical perspectives or representing the mathematics in different ways until they find methods that enable them to make progress . . . are flexible and resourceful problem solvers . . . work productively and reflectively communicate their ideas and results effectively . . .value mathematics and engage actively in learning it" (p. 3).

5 It is clear to me that these conversations themselves have a pedagogical influence on how students see themselves. Even though I am not trying to show causality, I acknowledge that this complicates the analysis. Attempting to make sense of this is an ongoing effort.

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