

# Plotting Inequalities, Building Resistance

*High school students use math to reflect on social inequality*

BY ADAM RENNER, BRIDGET BREW, AND CRYSTAL PROCTOR

MEDIA DEPICTIONS OF SAN FRANCISCO show idyllic images of fog pouring under the Golden Gate Bridge or happy tourists riding cable cars, but rarely the mostly nonwhite neighborhoods of the east side. San Francisco public schools have a bad track record of mimicking this masquerade, with very low numbers of African American and Latina/o students making it to senior year, and less than a quarter of those who do, graduating with the credits to move on to college. Our high school, the June Jordan School for Equity (JJSE), is located on the east side of the city, and was started by a group of teachers and parents who were disturbed by the high numbers of black and brown youth being underserved and then dropping out.

We are an intentionally small school with a focus on social justice.

Our commitment to send students of color to college means that they need a strong math education. As members of the math department, we believe, like Bob Moses, that math literacy in itself is a civil rights issue for students of color. We have seen too many “math haters” end up in remedial classes in college, short-circuiting their career options.

The teachers who helped found our school were mostly from the humanities departments, and it is easier to imagine getting straight to a student’s heart and experiences with a great piece

of literature or history told from a non-oppressor perspective than it is to imagine the quadratic formula liberating anyone. Part of our school’s mission is to help our students become agents of social change, so making explicit connections to social issues in math class is something that we try to do, though many math standards do not make this easy. Still, when the lesson involves important math skills, social justice, and something that will grab student attention, there is the potential that class will be exciting instead of mundane.

## The Scatter Plot Project

No one took making explicit social justice connections more seriously than Adam Renner, who started as a 9th-grade math teacher at JJSE in fall 2010 after many years as a teacher educator at the university level. In one of his first major projects, he had his students use math skills as a way to dig into a deeper understanding of the chasmic divide between rich

and poor in our city. He wanted to shed light on the impact of economics and the structures of racism on education, housing, and job opportunities.

Adam began by introducing his students to [ZIP Skinny](#), a user-friendly website for finding and comparing data about local communities. Our students live primarily in three San Francisco ZIP codes: the Excelsior, Visitacion Valley,

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and Bayview/Hunters Point. Along with mining for data in these ZIP codes, Adam selected four other ZIP codes for comparison: the Mission (an eclectic, centrally located neighborhood), the Presidio (one of San Francisco's wealthiest neighborhoods), and the Outer Sunset and Outer Richmond (two neighborhoods along San Francisco's Pacific coast). He asked the students to record in a table the following data: median neighborhood income, percentage of people with at least a high school diploma, percentage of people with at least a bachelor's degree, unemployment rate, and percentage of nonwhite residents. The 9th graders had to find these data independently using ZIP Skinny. Then, in carefully constructed groups, they had to graph two different sets of data on the same coordinate plane in order to discover the relationship between the sets of data. One example of a scatter plot they created was comparing  $X$  = median income vs.  $Y$  = high school completion; another was  $X$  = college completion vs.  $Y$  = percentage of nonwhite residency. In this way, students could see what it means for two circumstances to be related or correlated, but not necessarily by cause and effect. They also saw the difference between a weak correlation (the points are spread out) and a strong correlation (the points are almost in a line), as well as the idea of positive correlation (one circumstance increases with the other) and negative correlation (one circumstance decreases as the other increases). As they were learning the mathematical terms for data analysis, they began to discover that math can describe and order their world.

### Seniors as Mentors

Crystal, who teaches probability and statistics, had a class of JJSE seniors who were completing a similar exercise using spreadsheets and the various graphing and analysis functions of Microsoft Excel. We decided to do a group activity with the seniors and the 9th graders that would further develop basic math skills like plotting points as well as data analysis. We brought the three JJSE math teachers, the 60 or so 9th graders, and the 12 prob/stats seniors together to

engage in some cross-class mentoring and jointly discuss these issues.

The mathematical purpose for the seniors was to establish which data would pair well together and to be able to share that information with the 9th graders. The mathematical purpose for the students was to understand the spread of data in order to scale and label each axis and to plot points.

The social purpose for both age groups was to work together as a community in order to have conversations about the implications of the data. The data essentially reveal that people in San Francisco have different life experiences based on the neighborhood where they live, and that neighborhood is strongly correlated with race.



We wanted our students to have conversations about the statistics that seem to prove the racism that many of them experience, what that means for their communities, and what they might do about it.

Crystal asked the seniors to prepare a short lesson—based on the data that both classes had discovered and analyzed—that would introduce a new variable and help the 9th graders create a scatter plot. Her class prepared for teaching the 9th graders by spending time in class talking and doing math before meeting with the younger students. She asked the seniors: “What makes a neighborhood?” The kids talked about the kinds of specifics that define the character of a neighborhood. For example, they mentioned

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*“Gentrification might be a reason that more nonwhite people means more moving.”*

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the number of payday loan stores as well as the demographics (e.g., age, race, gender, education level). Each senior decided which variables to use and created their scatter plots themselves, both by hand and using Excel. This preparation allowed the seniors to feel comfortable with the math that they were about to teach. Crystal did not spend class time talking about how to interact with 9th graders, but we will have that conversation when we do this project again in the future. We paired each senior with five or six 9th graders.

On the first day of the project we met in the cafeteria and the seniors led their groups in discussing the data and creating large scatter plot posters. Although the 9th graders had been exposed to plotting points on a coordinate plane, the issue of how to scale each axis—“How might we label the X-axis for unemployment, which ranged from 2.1 to 5 percent, differently from how we would label it for median income, which ranged from \$37,000 to \$740,000?”—requires sophisticated logical reasoning skills that the seniors had to demonstrate.

Questions about what the data mean, not only how to plot it, led to some rich conversations. One group’s data showed that neighborhoods with more women were correlated with less unemployment. Ninth-grader Kari asked Shauna, her senior leader: “Isn’t it more normal for women to stay home with kids while men go to work?” Shauna laughed gently: “Who goes to work where you live?” Kari was relying on a stereotype about gender roles that is simply not true in many households. Shauna had learned in her three years at JJSE how the increasing number of men of color in prison has led to neighborhoods where most families are led by women who are the sole support of the household.

On the second day of the project we all met in the library so that groups could complete their scatter plot posters and so that seniors could lead their groups in a discussion about the data.

Some of this discussion centered on the math (e.g., how tight was the correlation and was it positive or negative), but the primary focus was conversations about what the data reveal about our city and what, if anything, we can do to shift some of these trends. During the presentations Mimi, a senior, talked about her group’s scatter plot, which showed a negative correlation between nonwhite residents and resident stability (how long people stay in their homes). She said, “Gentrification might be a reason that more nonwhite people means more moving.” In her small group Mimi discussed new condominiums that are being built in the Bayview district that are prohibitively expensive for many families who have lived in that area for multiple generations. Mimi had one of her 9th graders speak after her. Although the 9th graders did not show a clear understanding of gentrification (yet), she was able to talk about plotting the points, which was a new skill for her.

The 9th graders had to consider what it meant when points were close together in a pattern, and what it meant when they were spread out. Sometimes, the data were confusing. There seemed to be a positive correlation between number of kids and wealth of a family, but upon further inspection the 9th graders had not scaled the axes correctly, and what one may expect (that more kids means a family has less wealth, at least in most neighborhoods) turned out to be true.

The 9th graders were rapt while being taught by the seniors in ways that they simply are not with us, their teachers. Suddenly the ability to plot and analyze data points became a tool for 9th graders to engage with cooler upperclassmen. The seniors did a post-project reflection in their class, and one student wrote, “The freshmen listened to us because we are role models and they respect us, sometimes more than the adults.” Another senior observed, “Students who would not participate during class with teachers

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and other classmates participated with us, which made teachers feel surprised yet excited at the same time.” We were.

Bringing the 9th graders into the conversation about the intersection of math and social justice was important, but the unintended result of the project was what it taught the seniors. The senior reflections showed that they felt like math scholars and community leaders during this process, even though as 9th graders most of them were intimidated and uninterested in math. The seniors were moved by the sense of responsibility that comes with teaching. Marshall wrote: “I felt like a teacher because everyone was listening to me and everyone was looking up to me to understand how to plot points, how to read a graph, and how to compare categories.”

### **What Does It Mean? What Can We Do About It?**

The math was straightforward, but the statistics about our neighborhoods were wrought with emotion. They revealed some upsetting truths about our city. In their final analyses, 9th graders had the following to say: “The graphs show us that nonwhite residents of San Francisco have a difficult time with money and finishing high school and continuing to get their bachelor’s degrees like white students.” Sage’s group worried: “It lets us know how the incomes are, and they are really low. It makes us feel bad because we should be getting a higher income and we have no idea what to do about it.” Reactions ranged from “Indifferent” to “We don’t care about it” to “The graphs show to us the need to start changing for the better.” Regarding what to do, some students were equally fatalistic: “No matter what we do, it’s not going to change.” Others showed a spark of passion and indignation: “It makes you

feel like there is racism in San Francisco. It makes us feel bad there are not equal rights. We should make our own city.”

The statistics provided both the 9th graders and seniors with a tool for discussion, but did not reveal something completely new. We have students who live in a housing project that frequently does not have running water; they turn on MTV to see people their age celebrating birthdays with celebrity entertainers and new cars. Many of our students’ lives are characterized by prevalent violence—whether it be the gangs that operate in our school’s neighborhood, the complicated way some of our students must travel to school to avoid specific neighborhoods, and/or the cycle of violence in several of our students’ families. They enter high school knowing that their lives are different from the media’s depiction of an American teenager, and this math lesson helps explain those differences.

To some it may seem irresponsible to show these statistics to 9th graders. But we trust that our students, even the youngest, can learn about the real circumstances that surround them. In fact, we feel strongly that it is dangerous *not* to have discussions with students about race and class. They have seen and lived with the injustices for their entire lives, but are programmed to believe that poverty and violence are natural or that members of their communities and families just make bad decisions that lead to these outcomes. By having conversations based on numbers we are giving them the analytical tools to decipher the deluge of these messages, which is a step toward them being able to change the world around them. Math offers us a chance to analyze our world.

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This project gave seniors an opportunity to claim ownership of what they have learned about inequities during their time at JJSE. When asked what we should do about these truths, one senior wrote that city officials should really understand these statistics: “It is possible to look at the ZIP codes on their own and act accordingly in each ZIP code, and not lump them all together. One solution for the whole city couldn’t possibly help everyone.” Another senior vowed: “I want to go to college and earn a degree and come back and help these low-income communities throughout San Francisco to fight against this environmental racism.”

As educators we believe that at least part of the solution is people coming together to learn. Students studying the circumstances of their neighborhoods is an activity in community building, and communities in solidarity may be the strongest antidote to some of these statistics.

The inequality our students experience is planned; it is plotted. And, so we, in turn, show them how to plot the(ir) inequality to build resistance. We are learning how to study in a way that puts students at the center of the academic experience. *They* are the curriculum.

*This article would be incomplete without sharing the sad news that one of the authors, **Adam Renner**, died suddenly and unexpectedly in December 2010 at the age of 40. Before coming to teach math at June Jordan School for Equity in San Francisco, Adam was an education professor at Bellarmine University in Louisville, Kentucky. Adam was a true warrior in the fight for social justice and his loss has been devastating to many people and communities. Though the world was definitely a better place with Adam in it, it is in his honor that we will continue to fight.*

**Bridget Brew** and **Crystal Proctor** both teach math at June Jordan School for Equity. Names of students have been changed.



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