Promoting Respectful

Students in an urban high school learn to appreciate diversity and respect multiple viewpoints as they help one another succeed in mathematics.

Jo Boaler

One of the aims of schools should be to produce citizens who treat one another with respect; who value the contributions of those with whom they interact irrespective of race, class, or gender; and who act with a sense of social justice. Mathematics teachers incorporated these priorities into their instructional practices in a diverse, urban high school in the San Francisco Bay area. Students not only developed a more respectful culture but also made substantial gains in mathematics.

In a four-year longitudinal study conducted in three high schools between 2000 and 2004, my graduate students[1] and I followed approximately 700 students as they progressed through their mathematics classrooms. The urban school included in the study—which we refer to as Railside because trains pass just feet away from classroom windows—is located on what locals think of as "the wrong side of the tracks." Students come from homes with few financial resources, and the school population is culturally and linguistically diverse, including many English language learners. In addition to Railside, we included two suburban schools in the study.

We administered mathematics tests to students at the beginning and end of their freshman year and at the end of their sophomore and junior years. Incoming freshmen at Railside scored significantly lower on the test than did incoming students at the other two schools. By the end of the year, however, they had caught up with their suburban peers. By the end of their sophomore year, they were outperforming the students from the two suburban schools. During their senior year, 41 percent of Railside students were in advanced classes of precalculus and calculus, compared with approximately 27 percent of students in the other two schools. In addition, in surveys and interviews, the Railside students were consistently more positive about mathematics from their sophomore year on (Boaler, 2004).

Our study employed a range of qualitative and quantitative research methods, including 600 hours of classroom observations, questionnaires, interviews, and multiple assessments. These different methods enabled us to understand features of the school's approach that encouraged positive and respectful intellectual relations and high achievement. Important dimensions of the mathematics teachers' work included collaboration in designing curriculum and teaching methods, a shared commitment to equity, heterogeneous classes, and a teaching approach in which students worked in groups on

Learning


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complex conceptual problems.

The high achievement of the Railside students, many of whom came to school with weak mathematical knowledge, was noteworthy. However, the mathematics teachers at Railside achieved something else that some would argue is more important: They taught their students to respect one another. As a result, the ethnic cliques so evident in many schools did not form. Indeed, lessons were calm and peaceful, students were productive, and few behavioral problems surfaced. In interviews, students told us that because of the approach used in their mathematics classes, they learned to respect people from different cultures and backgrounds and to open their minds to different ways of thinking.

At Railside, lessons were calm, students were productive, and few behavioral problems surfaced.

The Right Climate for Learning

Approximately 18 years ago, in response to low student success rates, the mathematics department at Railside decided to change the way its teachers taught mathematics. The department chose to move to a more conceptual curriculum and, later, to eliminate tracked classes. The teachers developed curriculum around the "big ideas" in mathematics. The department also adopted *complex instruction*—an approach designed to counter differences in social and academic status in mixed-ability classrooms—and teachers used groupwork activities that fostered higher-order thinking (Cohen & Lotan, 1997).

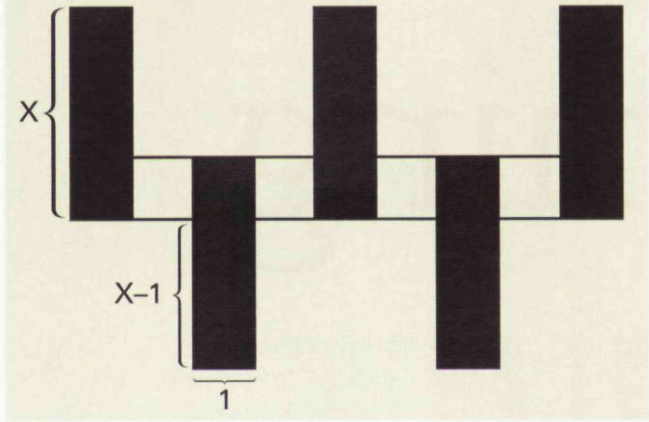
The 12 teachers in the mathematics department shared similar goals for their students. The department strongly influenced teacher recruitment and hiring and had been able to select like-minded, equity-oriented teachers for many years. Teachers also benefited from the department's links with universities and other professionals to learn about effective methods to support their teaching. The teachers worked collaboratively, spending a great amount of time designing curriculum content, discussing teaching decisions and actions, and generally improving their practice through sharing ideas. One study found that the teachers spent approximately 650 minutes each week planning, individually and collectively (their paid work week provides 450 minutes of preparation time) (Horne, 2002).

By the time we started our research study on mathematics teaching and learning in the three schools, Railside had already developed its innovative approach. The mathematics teachers in all three schools were knowledgeable and highly professional, but Railside's mathematics teachers worked more

collaboratively with one another and shared a common commitment to heterogeneity in the classroom.

At Railside, positive and respectful intellectual relations—which I have termed *relational equity*—depend on three important premises: committing to the learning of others, respecting the ideas of others, and learning to communicate.

FIGURE 1. Find the Perimeter of This Shape



Railside students worked collectively to solve this problem.

Committing to the Learning of Others

Working in groups encouraged high levels of respect and concern among students that transcended race, class, and gender boundaries. In various research studies in both England and the United States, I have interviewed hundreds of students who have worked in groups (Boaler, 2002). In most cases, students report that they prefer to work in groups rather than work alone, but they generally list benefits that refer exclusively to their own learning. At Railside, however, students voiced a clear concern for the learning of their classmates as well as for their own learning.

For example, when asked whether he would prefer to work alone or in groups, one freshman, Amado, replied,

> I think it'd be in groups 'cause I want to help people that doesn't know how to understand. I want them to be good at it. I want them to understand how to do the math that we do.

Students talked about the value and enjoyment that come from helping one another. Said Ana, a junior at Railside,

> It's good working in groups because everybody else in the group can learn with you, so if I don't understand but the other person does, they can explain it to me, or vice versa. I think it's cool.

One unfortunate but common side effect of some classroom approaches is that students develop beliefs about the inferiority or superiority of certain students. In the two suburban schools in which we worked, students referred to their peers as being smart or dumb, quick or slow. At Railside, the students didn't talk in these terms. They didn't think that all students were the same, but rather than label their classmates, they came to appreciate a variety of student attributes.

Students Help Students Learn

The equitable ways in which Railside students treated one another were impressive. In one example of group-work that we videotaped, three students were working on the problem of finding the perimeter of the shape shown in Figure 1.

The shape is made up of 1 x 1 tiles and X x 1 tiles, which have a length of X and a width of 1. Students can derive the perimeter in several different ways. The students in the video counted around the shape and found that they had 2 X's, 8 (X–1)'s, and 18 1's. They then simplified the expression: $P = 10X + 10$.

When the teacher walked over to the group, the students told her the correct perimeter. Then the teacher asked one student, Ana, "Where is the 10?" (meaning, "Where is the 10 on the diagram?"). Ana didn't know the answer. As the teacher walked away, mentioning that she would come back later, she reminded the students that Ana needed to be able to explain. The students worked with Ana, helping her understand what 10 referred to in the shape and how it had been derived. Ana was persistent in pushing for understanding. When the other two students told her that they had started with 18 and subtracted 8, Ana said, "She's going to ask me where I got the 8 from." Ana's push to understand the diagram and the associated mathematical operations, along with the patient support and help she received from the other members of her group, were typical of the ways in which students worked in Railside's mathematics classrooms.

A Collective Endeavor

The Railside teachers worked hard to create classrooms that approached learning as a collective, rather than an individual, endeavor. This involved teaching students to take responsibility for one another's learning, an idea that some might find controversial or even negative. Teachers continually reminded students that they needed to work together as a group and make sure all members of the group understood the work. They reinforced this message by grading group discussions and, occasionally, by giving group tests. Students worked through the test together, but the teachers graded only one of the group member's papers—and that grade applied to all the students in the group.

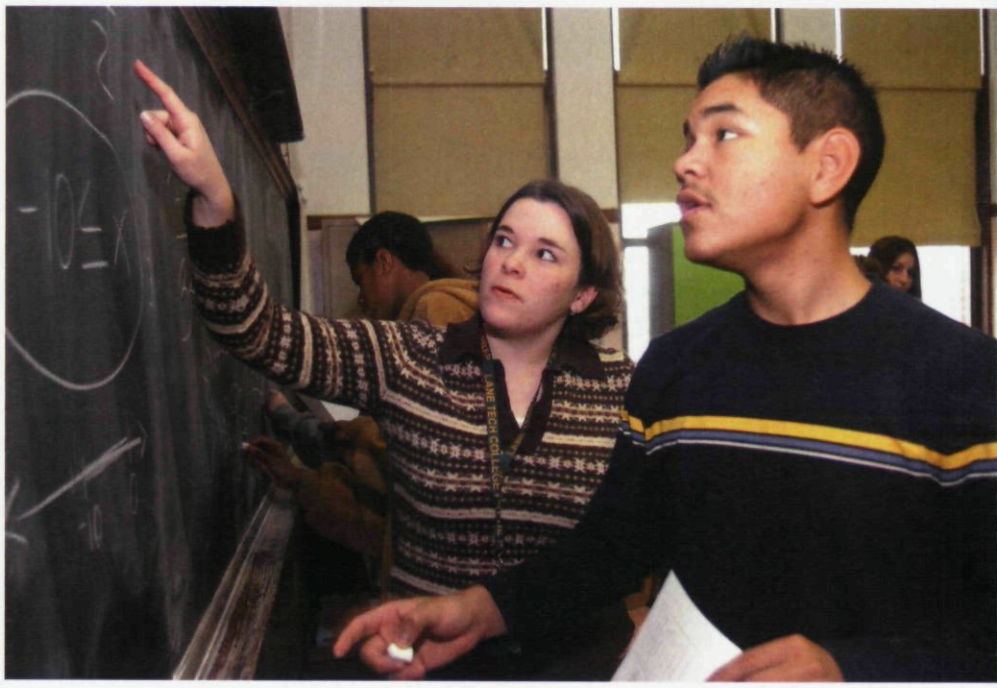
When asked whether math was an individual or a social endeavor, Bianca, a sophomore, explained,

> I think it's both—because individually you have to know the stuff so you can help others in your group, so you can explain it to them. Because you never know which one of the four people the teacher is going to pick. And it depends on that one person to get the right answer.

At the end of the first year of our project, we heard some resistance from the higher-achieving students, who complained about having to spend a lot of time explaining work to their peers. By the end of the second year, however, they had changed their minds. When asked whether helping others learn was a responsibility or a burden, a senior replied,

> People look at it as a responsibility. It's something we've grown to do because we've taken so many math classes. So maybe in 9th grade it's like, "Oh my God! I don't feel like helping them. I just wanna get my work done. Why do we have to take a group test?" But once you get to AP Calc, you're like, "I *need* a group test before I take a test. Thank God I'm in a group!"

The students changed their minds partly because they found that explaining a problem deepened their own understanding and partly because their orientations had shifted from regarding their enterprise as individual and competitive to regarding it as collective. The teachers spent a lot of time reinforcing the message that everyone had different strengths and that there were many ways to be smart. Students heard and believed that message. In one of our questionnaires, we offered the agree/disagree statement, "Anyone can be really good at math if they try." At Railside, 84 percent of the students agreed with this, compared with 52 percent of students in the study's two other schools.



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The students approached learning as a collective, rather than an individual, endeavor.

Respecting the Ideas of Others

Mathematics has an important role to play in developing relational equity, just as relational equity has an important role to play in developing students' mathematical knowledge. The act of considering different mathematical ideas in the course of problem solving promotes a respect for and understanding of different viewpoints. This quality transcends the mathematics classroom. The mathematics teachers at Railside did not use curriculum designed to promote social justice (Gutstein, Lipman, Hernandez, & de los Reyes, 1997). Nor did they spend a lot of time relating classwork to students' cultures, a practice that has proved successful in promoting equity (Lee, 2001). Classroom discussions were often abstract and mathematical, but as students learned to value the contribution of different methods, perspectives, and partially correct or even incorrect ideas, they also came to value different people's insights. Richard Shweder, a cultural anthropologist and psychologist, talks about the importance of considering different perspectives in the workings of a democratic society:

> It is often advantageous to have more than one discourse for interpreting a situation or solving a problem. Not only alternate solutions but multidimensional ones addressing "several orders of reality" or "orders of experience" may be more practical for solving complex human problems. (2003, p. 100)

Many students at Railside talked about the ways in which they had become more open-minded as a result of the practices they learned in their mathematics classes. Said Tanita, a senior at Railside,

> When you're debating a rule or a method, you get someone else's perspective of what they think instead of just going off in your own thoughts. That's why it's good with a lot of people.

Carol, another senior, agreed. "Most people opened up their ideas," she said.

A key aspect of the approach at Railside was creating multidimensional classrooms. In many mathematics classrooms, teachers value one practice above all others—that of executing procedures correctly and quickly. Such classrooms are unidimensional—there is a single pathway to success.

At Railside, the teachers created multidimensional classes by valuing many dimensions of mathematical work. This was partly achieved by having students tackle group-worthy problems. These are open-ended problems that illustrate important mathematical concepts, allow for multiple representations, and have several possible solution paths (Lotan, 2003).

Teachers also valued various methods of problem solving, which their grading schemes reflected. The students at Railside achieved high grades not only because they got correct answers but also because they asked good questions, rephrased problems, explained ideas, worked logically, justified their methods, or brought a different perspective to a problem. Simply put, there were many more ways to be successful, so many more students were successful.

Learning to Communicate

The students at Railside learned specific methods of communication and support, one of which was gauging their classmates' understanding by asking probing questions. In many mathematics classrooms, students help one another by sharing the particular method they used to solve a given problem. At Railside, the students learned more sophisticated ways of helping. Ana explained:

> I don't like to leave people behind. So if someone's sitting there quiet, it's probably because they don't know how to ask a question, or they just don't get it. So then I'll help. I'll start from a bigger question about what we're really doing.

For example, if someone said, "I don't get it," students would typically ask such questions as, "What is the question asking you?" or "When have you seen this kind of problem before?"

In their mathematics classes, students learned that they could solve complex problems through persistence and collaboration.

Groups did not always work smoothly, with some students having off days and generally being reluctant group members. Group members handled these difficulties on their own, reflecting a sense of responsibility not commonly developed among adolescents. Susan explained how she tackled her group's problem:

> There's a person in our group—I won't say no names—who just kind of lies around. Another guy just likes doing stuff by himself. I go over and talk with this one, and once I'm done, I go over and sit by the one who really doesn't care. I ask him, "Are you understanding this stuff?"

What Matters

It is important to consider whether students are learning these principles and practices of equity in school. Yet the kinds of equity that test scores measure don't encompass these concerns. In their mathematics classrooms, the students at Railside learned that they could solve complex problems through persistence and by collaborating with others. They learned to value the varied ways in which people solve problems. They learned to respect students regardless of ethnicity, gender, or social class. They learned effective methods of communication. These are valuable practices that the students will take with them into the rest of their lives. EL

[1]Karin Brodie, Jennifer DiBrienza, Nick Fiori, Melissa Gresalfi, Emily Shahan, Megan Staples, and Toby White.

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