The Impact of Identity in K–8 Mathematics Learning and Teaching:

Rethinking Equity-Based Practices

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Chapter 4

Cultivating Mathematical Agency: "He Was Suspended for Being Mexican"

An urban middle school mathematics teacher was deeply disturbed by an exchange with one of his seventh-grade students:

Mr. C: Joaquín, where is Mario today?

Joaquín: He ain't here. He was suspended for being Mexican.

Mr. C: What did you say?

Joaquín: This school is always picking on Mexicans.

Mr. C wondered whether Joaquín's claim could be true. Could the school be engaged in racial profiling of students? What could he do? Through critical reflection, confidence in his instruction, and commitment to his students as strong mathematical learners, this teacher created two standards-based data analysis mathematics lessons that engaged his middle school students in a mathematical investigation to determine whether Joaquín's claim was true.

The equity-based practices in Mr. C's mathematics classroom facilitated deep mathematical analysis (using concepts related to ratio, percent, and proportional reasoning) of an issue that strongly affected his students. Furthermore, the lessons empowered students, giving them a better understanding of how mathematics can be useful beyond the classroom walls and can promote social change. The lessons nurtured positive mathematical identity and collective mathematical agency among Mr. C's students.

The Claim: "He Was Suspended for Being Mexican"

Mr. C, a National Board Certified Teacher, had been teaching in urban elementary and middle schools for more than twelve years. A white male with a strong interest in mathematics, Mr. C had been teaching at this urban middle school for five years. Midway Middle School and its community had experienced a recent demographic shift. The school's longtime African American population had significantly decreased while three new immigrant populations—Cambodian, Mexican, and Ukrainian immigrants—were taking up residence in the nearby public housing development. The school had the highest rates of poverty (90 percent free and reduced-price lunch) and ethnic diversity (90 percent students of color) in the district. Racial and ethnic tensions were evident among the different subpopulations of the school. Furthermore, because of low test scores, this school was currently in the state's school improvement program and was under a great deal of pressure to improve student achievement, especially in mathematics.

In the face of these extensive challenges and complexities, Mr. C cared deeply about his students and was dedicated to supporting their success. This was an anchoring commitment of his instructional practice. In fact, he routinely posted the following promises in his classroom:

- I will work with you until you understand.
- I will not waste your time—every activity is tied to a learning standard.
- I will ensure that our classroom functions as a positive learning community.
- I am open to suggestions.
- I will learn along with you.

These five promises set the tone for Mr. C's mathematics classroom. Clearly, Mr. C was a teacher who valued learning (his own and his students') and was open to creating a classroom community that was supportive and positive for all.

In this context, Mr. C was seriously troubled by Joaquín's claim about the school "picking on Mexicans." He shared his concerns with one of this book's authors, Julia Aguirre, with whom he had previously collaborated on a mathematics education project. She suggested that he mathematize Joaquín's claim—in other words, use mathematics to determine whether the claim was true or false. Joaquín's statement was a *claim*, she emphasized. What was the evidence? She gave Mr. C a recent book, *Rethinking Mathematics: Teaching Social Justice by the Numbers*, by Eric Gutstein and Bob Peterson (2005). She called his attention to a short chapter on racial profiling, titled "Driving While Black/Brown." She suggested that Mr. C read this chapter and see whether he could draw some parallels to help his students analyze this claim about suspensions.

Mathematics Lessons to Evaluate the Claim

The following week, Mr. C contacted Dr. Aguirre to share his excitement about what had transpired in his seventh-grade mathematics class as a result of two lessons that he had designed and implemented. He had read the chapter and created the two lessons to investigate Joaquín's claim (activity sheets for "Midway Suspensions" [lesson 1] and

"Two Sides to Every Story" [lesson 2] are available at nctm.org/more4u). Furthermore, he had talked about the situation with his principal, who had agreed to come to the class to hear the students' conclusions. Mr. C reported that the students immediately engaged with this mathematical task, showed sustained persistence in constructing a mathematical argument, and presented their conclusions orally and in writing to the principal. The following discussion outlines the equity-based practices of Mr. C's mathematics lessons.

Going deep with mathematics

Mr. C designed two lessons that required students to determine the validity of Joaquín's statement by organizing and analyzing real data that he obtained on suspensions at Midway Middle School. In the first lesson, "Midway Suspensions," students investigated data on the general population at Midway, sorted by racial and ethnic group, along with data on the numbers of suspensions by students in these groups, and additional data on the numbers when multiple suspensions by individuals were taken into account. For the second lesson, "Two Sides to Every Story," students worked with grade-level data on numbers of students (boys and girls in different demographic groups) suspended for particular offenses. Both lessons were tied to specific grade-level state standards on data analysis. The second lesson, for example, supported the process "Solves Problems and Reasons Logically," and more specifically, the students' ability to "draw conclusions and support them using inductive and deductive reasoning."

As students began their work with "Midway Suspensions," the mathematical complexity of the activity became evident in the comparisons of ratios that it required them to make. They increased their computational fluency by representing ratios as fractions, decimals, and percentages. They generated mathematical questions related to other factors that might show the claim to be true or false. This work raised the issue of the "reasons" for suspensions at Midway. Were specific groups of students overrepresented in suspensions for a particular offense?

Mr. C designed the second lesson specifically to enable his students to explore these student-generated mathematical questions. This activity had multiple goals. It facilitated group collaboration and construction of a mathematical argument, and it included a social action component to galvanize change. Figure 4.1 presents this social action component, which proposed a letter-writing campaign using math-based arguments as a plan to make positive change in the school's learning environment.

> **If your group had the power to change school policy, given your mathematical analysis, which offenses would you target to change? Why? Write a letter to the principal that describes your plan for positive change in the student learning environment at Midway. (Minimum length is 1 page.)**

Fig. 4.1. Mathematizing school policy

These two activities engaged students in complex mathematical problem solving with a specific purpose that sustained interest and sparked additional mathematical questions. The lessons certainly were not the only kind of mathematical activity in this class, but going deep with the mathematics in these lessons resulted in an increased level

of mathematical engagement and discourse, with students debating, computing, making mathematical comparisons and justifications, and communicating those ideas orally and in writing to support a position.

Leveraging multiple mathematical competencies

The tasks of Mr. C's lessons had multiple entry points, thus facilitating engagement by students with varying mathematical competencies. The activity sheets structured an explicit process of mathematical investigation. Collaborative teams were a norm in Mr. C's classroom, and the teamwork positioned various students as experts in this process, while underscoring the need for engagement and multiple mathematical competencies. For example, in working on the lessons on suspensions, some students with strong computational skills demonstrated to team members how to convert ratios expressed as fractions, obtained through division, into percentages. Other students with a depth of conceptual understanding pointed out which pieces of data needed to be compared and why. Mr. C structured the teams with specific roles and responsibilities that reinforced support, accountability, and progress; the roles are delineated explicitly in the activity sheet for lesson 2, "Two Sides to Every Story." He reported that his students showed a desire to work together and learn from one another. The strategies that he used recognized and leveraged different mathematical competencies to facilitate complex mathematical problem solving.

Affirming mathematics learners' identities

The second lesson, "Two Sides to Every Story," was inspired by the student-generated mathematics questions elicited in the first lesson. Students began to conjecture why members of specific groups of students were being suspended. Was there a relationship between race or ethnicity and specific offenses? Mr. C believed that his students were primed and ready to validate their questions in the second lesson. He observed them poring over the data to answer questions. Mr. C identified this enthusiasm, persistence, and analysis as evidence of his students' expanding positive mathematics learner identities. The students wanted to know more. They wanted to validate their own claims and make their case to the principal.

Although Mr. C's students had no problem sharing their opinions about issues, he believed that this was the first time that they had experienced the need for mathematics to lend support to a position—"to back up their claims." He saw their confidence increase as they prepared their arguments and wrote their letters.

Challenging spaces of marginality

Mr. C guided his students in mathematizing a specific claim that had been made by a student and reflected a larger societal reality experienced by many students of color and their families—racial profiling. These lessons also tapped into an implicit undercurrent of racial tension that had negative effects on student and community relationships. Through the opening written statement of the first lesson (see fig. 4.2), Mr. C. made his position about racism clear to his students.

"He was suspended for being Mexican"

Last week, I heard one of my students say this in class when describing why a friend of his was recently suspended. If this is true, I want to address the injustice immediately because I refuse to work in a racist school. Before I complain to our principal, I need to have data ready.

Fig. 4.2. Mr. C's statement on suspensions

In fact, Mr. C set up the lessons in response to racism, modeling for students the need to have "data ready" to "address the injustice" if the allegation proved to be true. This white male teacher openly used the word "racist" to describe the alleged policy, and he explicitly positioned himself against such policies and declared his commitment to changing them. He enlisted his students in helping, and they enthusiastically responded. The investigations positioned the students as mathematical experts who could give voice to an authentic concern that they experienced (Turner and Strawhun 2007). The lessons made students problem solvers and advocates for themselves and others, thus *centering*, rather than marginalizing, them as confident mathematical learners with a purpose.

Drawing on multiple resources of knowledge

A strength of Mr. C's suspension lessons was that they drew on the students' resources of knowledge to engage them in complex mathematical problem solving. The context of the lessons was an authentic issue that affected students. Their teacher gave them access to real data that required their mathematical knowledge to organize, analyze, and use to support a position. They drew on their own knowledge to generate additional conjectures about the types of offenses that might be involved. In addition, the students worked in teams, which provided peer and mathematical resources to solve these novel and complex problems. Furthermore, their letters to the principal revealed additional information about peer-to-peer interactions that were fueling negative race relations within the school, and this information prompted surveys and other strategies to promote school-community dialogues. The lessons had a positive impact on mathematical learning and identity, as well as school-community interactions.

Conclusion

Although some of the of strategies that Mr. C used were already in his teaching toolbox, these lessons extended mathematical learning and engagement in more substantive ways than Mr. C had succeeded in doing before in his classroom. For example, Mr. C believed that one of his strengths in mathematics lesson design was his ability to connect mathematics to students' lives and interests. He considered this to be a part of the multicultural emphasis in his teaching. He knew that students liked cars, had jobs, or were interested in popular culture and technology, so he often introduced mathematical ideas by using these contexts. Yet, the suspension lessons were different. They were

driven by a troubling claim made by a student that related to alleged systemic racism. Although Mr. C was deeply affected by this claim, the thought of using this situation as a mathematical context for a lesson did not occur to him. Dr. Aguirre's suggestion of a related reading helped expand his repertoire of meaningful mathematical contexts:

> I think my practice reflects my tools and understanding I have at the time. When I started teaching, I was content incorporating a pretty surface-level multicultural lens. For example, I had posters up showing math from cultures around the world. Later I started thinking about accessing the diverse knowledge my students bring, but even then, it was mostly about trying to make the content of word problems more meaningful and relevant. But after reading Gutstein's critical pedagogy, I realized how much I needed another tool or model to help me think about making math meaningful and accessible to my students. Reading Gutstein's work helped.

An important dimension of Mr. C's identity as a mathematics teacher was making mathematics meaningful and accessible to his students. As Mr. C suggests, this particular dimension evolved over time from making a more superficial connection (for example, through multicultural posters) to making a more critical connection involving issues of equity and social justice.

Mr. C combined many of his successful instructional strategies—such as tying lessons to learning standards and using teams with accountability systems to monitor progress—with a new mathematical context directly tied to an authentic problem faced by many of his students of color. When asked what made these mathematics lessons different from just "good teaching," Mr. C said that he believed the lessons enabled students to tackle a serious issue that needed to be addressed within the school and community. It gave the students a sense of the importance of using mathematics to support positions, rather than just relying on opinion.

Although Mr. C knew that he took a risk in having students analyze real data related to suspensions and race, he had faith that his school's administration had no deliberate intention of engaging in racial profiling and that the principal would be open to listening to students' analyses and ideas. Mr. C's confidence in carrying out the lessons was tied to his skills as a National Board Certified Teacher, his district reputation as a strong mathematics teacher, and a positive relationship with the administration. Further, the lessons embodied Mr. C's commitment to being an "advocate for kids." He was a critical partner in his students' mathematics learning process, and he helped position his students mathematically and socially to investigate a difficult situation. He believed that the lessons had a positive impact on their sense of mathematical identity and agency. The lessons empowered students as mathematical learners, giving them confidence and a sense of purpose as they worked to gain insights and offer solutions to complex problems and make positive changes in their learning environment.

The equity-based practices of Mr. C's mathematics lessons facilitated mathematical learning, positive mathematical identity, and collective mathematical agency for students. Mr. C drew on his existing areas of expertise to create an innovative set of mathematics lessons that validated and strengthened his students' views of themselves as mathematical learners. Valuing his students' learning was already a part of Mr. C's

mathematics teacher identity. He was a dedicated advocate for his students. He was committed to high expectations through mathematics standards. And he was devoted to helping students be intellectually and socially responsible for their learning.

Mr. C also faced common political and social challenges of urban schools, including accountability pressures to raise test scores and underlying racial tensions that had an impact on the learning environment of the school. His strong stance on making all lessons standards-based illustrated his commitment to high expectations within a high-stakes accountability system. At Midway, he had curricular flexibility as long as lessons were tied to standards. In addition, with these lessons, he took an explicit, public anti-racist stance. Mr. C made it clear to his students, 90 percent of whom were students of color, that he did not want to work in a "racist school." By acknowledging publicly what the claim alleged—that it charged that the school was racist—he positioned himself as an advocate for social justice in the eyes of his students.

Mr. C encouraged mathematical analysis and agency. His lessons enabled students with various types of mathematical competence to make valuable contributions. The lessons were tied to an authentic situation experienced by many students, whose knowledge and experiences they centered rather than marginalized. Students drew on their own resources—math, peer, community, and so on—to construct solutions and provide teachers and administrators with ideas for change. The lessons tapped into the expertise of students and advanced their mathematics learning. They positioned the students as possessors of mathematical resources and agency for analyzing and solving the problem related to Joaquín's claim.

DISCUSSION QUESTIONS

1. How do your curriculum and instruction cultivate mathematical agency?
2. What similarities and differences do you see between your commitment to student learning of mathematics and Mr. C's commitment? Are the outcomes of student engagement and mathematics learning in your classroom similar to those in Mr. C's classroom?
3. What kinds of authentic problems do your students face? Could you mathematize any of these problems? What are some ways in which you could identify pressing issues that students might want to change? How might you mathematize these problems?