

Culturally Specific Pedagogy in the Mathematics Classroom

Strategies for Teachers and Students

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Chapter 8

BLACK LIVES MATTER

A Context for Teaching Mathematics for Social Justice

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BLACK LIVES MATTER

A Context for Teaching Mathematics for Social Justice

Mathematics educators and scholars suggest using real-world problems to engage underrepresented children and youth in mathematics (Gutstein & Peterson, 2013; Leonard et al., 2010; Leonard & Evans, 2012). Issues related to gendered, racial, and/or social experiences provide opportunities to teach mathematics for empowerment (Leonard, 2009). For example, data and history may be combined to advocate for justice. From #OscarsSoWhite to #BlackLivesMatter (#BLM) to #NeverAgain, there are myriad contexts that can be used to teach mathematics for social justice. Teaching mathematics for social justice (TMfSJ) could begin with the notion of schooling and education itself.

The research presented in this chapter begins with an acknowledgment of the educational debt owed to Black and other disenfranchised Americans. The educational debt is followed by a historical overview of the voting rights era and its relevance to the current political landscape. Policies such as *Broken Windows*, *Stop-and-Frisk*, and the assault on Black bodies (i.e., Trayvon Martin, Rekia Boyd, Eric Garner, Michael Brown, Tanisha Anderson, and many others) are discussed as an introduction to an examination of the #BLM movement. Lastly, this chapter closes with a treatise on African-American firsts in mathematics and science (Journal of Blacks in Higher Education [JBHE], 2018) for without these achievements, America would not be America. Black millennials stand on the shoulders and the contributions of these great Americans who made a

difference in local, national, and global communities. Using the framework of culturally specific pedagogy, suggestions for TMfSJ will be interwoven within these contexts.

The Educational Debt

While president of the American Educational Research Association, Dr. Gloria Ladson-Billings (2006) presented research on the educational debt owed to Black and Indigenous people from historical, economic, sociological, and moral perspectives. The educational debt, much like the national debt, accumulates across time (Ladson-Billings, 2006). Beginning with the Emancipation Proclamation on January 1, 1863, and ending with the Hurricane Katrina tragedy in 2005, Ladson-Billings revealed how under-education has had a deleterious impact on multiple generations of Black and Indigenous families. Rather than recounting all of the factors impacting the lack of educational opportunity in this chapter, the educational debt is discussed from legal and historical perspectives. Discrimination lawsuits heard by the U.S. Supreme Court (e.g., *Brown v. Topeka Board of Education*) form the basis of the legal perspective. My ancestry is used as the historical context to understand the impact of disparate educational opportunities in the rural South. While Blacks had separate issues in the North with de facto segregation, that discussion is beyond the scope of this chapter.

In 1896, the *Plessy v. Ferguson* case institutionalized separate education for Black and White students in the U.S. for nearly 60 years. Although *Brown v. Board* ended de jure segregation in 1954, unfair lending practices and housing discrimination were deterrents to racial integration and, as a result, neighborhood schools remained (then and now) highly segregated by race and class (Chang, 2016; Rothstein, 2017; Taylor, 2016). Furthermore, since the 1970s, zero-tolerance policies have negatively impacted African-American students with suspensions and expulsions that have been linked to the school-to-prison pipeline (Chang, 2016; Taylor, 2016). Black boys are suspended

three times more often than White boys (Losen & Skiba, 2010), and Black girls are suspended six times more often than White girls (Morris, 2016). It is these systemic issues of segregation, discrimination, and inordinately punitive measures that contribute to unequal educational opportunities for African-American children (Davis, 2016; Ladson-Billings, 2017; Taylor, 2016).

From an educational perspective, this point is illustrated by tracing my ancestry, which I learned from DNA¹ testing is 75.6% West African, 21.8% European, 1.6% South and Southeast Asian, and 1% Other. Some of my ancestors of African descent were slaves and then sharecroppers in rural Mississippi, having been brought there from Alabama (fourth great-grandmother, Mrs. A, b. 1800), Georgia (third great-grandfather, Mr. S, b. 1805), Virginia (third great-grandfather, Mr. L, b. 1825), and South Carolina (fourth great-grandfather, Mr. W, b. 1801). However, I discovered that 1850 and 1860 U.S. Census records showed that one family of ancestors lived on 12 acres in Alabama as free Blacks. Slaves were not generally listed by individual name on the same census record as Whites until 1870. It is interesting to note the term *Mulatto* was used in the 1870 Census as the racial identification of several ancestors, who were owned by European slaveholders (and their descendants) that fought in the Revolutionary War. Thus, those who fought for freedom and liberty denied it to most of my African-American ancestors in spite of the fact that some of these ancestors were also their progeny. Genealogy research revealed that five generations of my maternal African-American ancestors lived in Oktibbeha County, Mississippi. Beginning with my maternal grandmother, Lou Ellen (pseudonym), these generations are shown in Figure 8.1 below.

Census records further revealed that none of Lou Ellen's great-grandparents could read or write. Their illiteracy was not surprising given they were born prior to 1865 and were most likely slaves on small farms or larger plantations in Oktibbeha County, Mississippi. The laws in Mississippi and other states

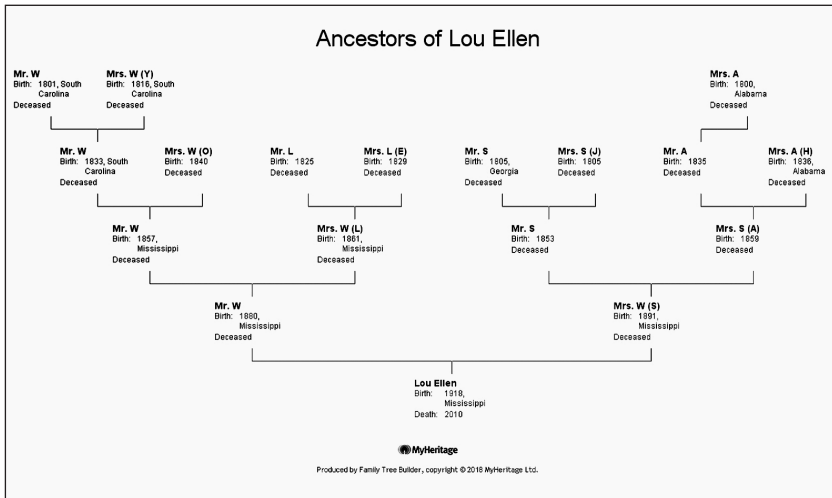


Figure 8.1 Hamilton Ancestry.

throughout the South, prohibited slaves from learning to read and write (JBHE, 2018; Ladson-Billings, 2006). In the next generation, two of Lou Ellen’s grandparents could read, and two could read and write. One generation removed from slavery, Lou Ellen’s parents had meager educational opportunities. Her parents could read, but only her mother could write. Lou Ellen and her two sisters attended a segregated elementary school in their community in Oktibbeha County. They were the first in the maternal line to complete elementary school through seventh grade, though they were unable to matriculate beyond that point. In the rural South, there were few high schools for Blacks in their own communities, which limited their opportunities to pursue higher education (Siddle-Walker, 2000).

In terms of work, most of my ancestors worked in agriculture until the early to mid-twentieth century when a phenomenon known as the great migration occurred (Wilkinson, 2010). Between 1916 and 1970, six million Blacks moved from the rural South to the industrialized North (Morris & Monroe, 2009). Several of my family members, including two uncles,

migrated from Mississippi to Missouri in the 1930s. One uncle was employed in the steel industry after learning a trade. Census records revealed the second uncle attended high school through the tenth grade. He later became a successful businessman and purchased his own home. When my grandmother, Lou Ellen, migrated to Missouri in the 1940s, she worked for that uncle until she could receive additional job training (Leonard, Walker, Cloud, & Joseph, 2017). As a result of my ancestors' determination to leave the South and move to the Midwest in search of a better life, my siblings and I were the first to receive a K–12 education outside of the rural South. Yet, we attended de facto segregated schools in Missouri.

To put our lives in context, a 110-year timeline (see Table 8.1) shows significant educational events and other achievements for Blacks in America (from 1870 to 1980) alongside annotations for my maternal ancestors, including my brother and me. From this timeline, one can see the steady progress Blacks have made in educational attainment as well as their contributions to American society. Although 2,000 Blacks had attained college degrees in 1900, this was only 0.0002% of the 8.8 million Blacks living in America at the time (U.S. Department of Commerce, 1993). Thus, the educational debt owed to Blacks who lived in the South with limited access to public high schools in the 1930s and 1940s is enormous. This is also true for those who were denied access to public universities until the 1960s.

Historically Black Colleges and Universities (HBCUs), like Alcorn State University and Rusk University, were the primary means for obtaining a college education for most Blacks in Mississippi prior to *Brown v. Board* in 1954. According to my mother, who lived in Starkville, Mississippi, until 1956, “Blacks were not allowed to step foot on the grounds at Mississippi State University.” Fortunate to be born after the *Brown v. Board* ruling, I was the first female in my immediate family to graduate from high school and the first to graduate from college in 1981. My younger brother was the first male to receive a bachelor's

degree in engineering in 1982. Yet, every relative who was a sharecropper mattered. They cherished their children and provided stable family units. Without their tenacity, strong educational values, and financial and emotional support, I would not have earned a PhD in curriculum and instruction with a focus on mathematics education from the University of Maryland in 1997. The foregoing legal and historical analyses illustrate Ladson-Billings's construct of the educational debt and provide evidence that lack of educational opportunity, rather than race, class, or culture, adversely influences academic success (Ladson-Billings, 2017).

As I observed when I taught in public schools, tracing one's ancestry is a culturally specific activity that middle school students are interested in and willing to research (Leonard, 2004). From a mathematics perspective, a family tree illustrates a natural pattern of base two. As the family tree grows beyond direct ancestors to include uncles, aunts, and cousins, the number of family members increases exponentially. Thus, a connection to algebra can easily be made with ancestry. In addition to building a family tree, students may collect data on educational attainment, occupation, age of marriage, and number of children. Furthermore, a timeline that aligns with the birth of students' ancestors to historical events in America puts their lives in perspective. Thus, students can learn how educational opportunity and historical events impacted their lives.

Voting Rights

According to the documentary *Eyes on the Prize: America's Civil Rights Years* (Hampton, 2010), the right to vote was the ultimate symbol of freedom for Blacks in America. Voting records on the paternal side of my family revealed a former slave registered to vote in 1867 in the state of Alabama. Yet, exercising the right to vote in the South was particularly challenging due to poll taxes, literacy tests, and other forms of intimidation and violence. According to a letter² written by Booker T. Washington to W. E. B. DuBois on January 27, 1904, Blacks in Alabama were

Table 8.1 Chronology of Significant Educational Events and Other Achievements of Blacks in America: Decades View 1870 to 1980

<i>Decade</i>	<i>Selected Events for Blacks in Higher Education¹</i>	<i>Birth of Author's Ancestors</i>
1870s	Twenty-two HBCUs in existence; Richard Theodore Greener first Black student to graduate from Harvard; James Webster first Black student admitted to West Point	Great-great-grandparents are sharecroppers in Mississippi
1880s	Forty-five HBCUs in existence, Spelman College (first HBCU for women) and Tuskegee Institute founded, 1881	Great-grandfather Mr. J. W. born
1890s	Sixty-four HBCUs in existence; Ida Gray first Black woman to earn a degree in dentistry from University of Michigan, 1890; W. E. B. DuBois first Black to earn a Ph.D. in history from Harvard, 1895; <i>Plessy v. Ferguson</i> —U.S. Supreme Court established separate but equal doctrine, 1896	Great-grandmother Mrs. W born
1900s	Seventy-eight HBCUs in existence; 2,000 Blacks earned college degrees, 390 from predominantly White institutions	
1910s	Julian Herman Lewis first Black Ph.D. in physiology, University of Chicago, 1915; St. Elmo Brady first Black doctorate in Chemistry, University of Illinois, 1916	Great-great uncle Mann Hamilton is lynched in 1912 Grandmother born in this decade (completed grade seven)
1920s	Eva B. Dykes (Radcliffe College), Sadie T. Mossell Alexander (University of Pennsylvania) and Georgiana R. Simpson (University of Chicago) first Black women to earn doctorates	
1930s	One hundred seventeen HBCUs in existence, 1932; George Maceo Jones first Black Ph.D. in civil engineering, University of Michigan, 1934; Maryland Court of Appeals rules University of Maryland Law School must admit Blacks, 1936	Mother born in this decade (completed grade 10); uncles migrate to Missouri

1940s	Marguerite Thomas Williams first Black Ph.D. in geology, Catholic University, 1942; Adelaide Cromwell first Black faculty member at highly selective liberal arts college (Smith College); W. Allison Davis first Black tenured professor, University of Chicago, 1947	Grandmother migrates to Missouri
1950s	Joseph T. Gier, engineering professor at UCLA, second Black faculty member tenured at PWI, 1952; Howard Thurmann first Black dean at PWI (Boston University), 1953; <i>Brown v. Topeka Board of Education</i> , 1954; Autherine Lucy first Black admitted to University of Alabama, 1956 (suspended and then expelled)	Mother migrates to Missouri; author born in Missouri during this decade
1960s	Four North Carolina A&T Black students hold sit-ins at lunch counters at F. W. Woolworth in Greensboro, 1960; Charlayne Holmes and James Hunter first Black students at the University of Georgia, 1961; James Meredith first Black graduate from the University of Mississippi, 1963; Vivian Malone first Black graduate from University of Alabama, 1965	Author attends de facto segregated school in Missouri
1970s	Black students at Jackson State University in Mississippi protest racial injustice (two deaths and 12 injuries), 1970; Eileen J. Southern first Black woman tenured as professor at Harvard, 1975; <i>Regents of the University of California v. Bakke</i> ruled on race and college admission, 1978; Sir Arthur Lewis, Black economics professor at Princeton, wins first Nobel Prize in economics, 1979	Author graduates from high school and attends Boston University
1980s	Federal government sues the state of Alabama in an effort to desegregate the system of higher education, 1983. Sylvia A. Boone becomes the first Black woman to become a tenured professor at Yale University, 1988	Author graduates with BA in Education, St. Louis University; Author's brother graduates with BS in chemical engineering, Washington University in St. Louis

Note

1. Source: Archives, Journal of Blacks in Higher Education (2018).

admonished to pay the poll tax by the February 1 deadline in order to vote. According to the Smithsonian Institute, the poll tax was highly effective in preventing Blacks from voting, as illustrated by the decline in the number of Blacks registered to vote in Louisiana from 130,000 in 1896 to 1,342 in 1904. A receipt from the Smithsonian archives revealed that the poll tax was \$2.50 (see Figure 8.2), while wages for farm labor were approximately \$11.76 per month in Alabama in 1895.³ Thus, the poll tax was roughly equivalent to one week's work for a sharecropper in Alabama. This unjust and unconstitutional hindrance effectively supported a hegemonic and racist system of bigotry and discrimination that disenfranchised and subjugated Black people in America. Remarkably, Booker T. Washington, who communicated regularly with Theodore Roosevelt from 1901 to 1917 and received a \$600,000 grant (worth \$14,724,772 in January 2018) from Andrew Carnegie in 1915,⁴ was out of touch when he suggested that Blacks simply pay the tax.

Selma, Alabama, became the major focal point in the struggle for voting rights in the South. In 1965, less than 1% of Blacks in Selma (Dallas County, Alabama) were registered to vote even though they made up more than half the population. Dr. Martin Luther King Jr. and the Student Nonviolent

No. 838 Birmingham, Ala. 4/9 1896

Received of J. M. Gillie (Col.) (White.)

the sum of Two & 50/100 Dollars
in full of amount of Poll Tax for the year 1895.

Poll Tax,		1	50
Assessor's Fee,			50
Collector's Fee,			50
<u>A. M. M. P. T. C.</u>			

Figure 8.2 Sample Poll Tax Receipt 1895.⁵

Coordinating Committee (SNCC), which was founded by Ella Baker, sponsored events that brought national attention to the voting rights issue in Selma. As a result, five marches took place in Dallas County, Alabama, that changed the course of history and illustrated the power of solidarity and nonviolent civil disobedience. The first march, on January 22, 1965, included 105 local school teachers who protested the arrest of a prominent citizen in Selma. When police refused to arrest the teachers, they marched to Brown Chapel African Methodist Episcopal (AME) Church, which became the epicenter of the movement. A second march took place at night in the nearby town of Marion on February 26, 1965. During the march, Jimmy Lee Jackson, a deacon in the Baptist church and civil rights activist, was shot and killed by an Alabama state trooper. In response to his death, the community planned to march from Selma to the state capitol in Montgomery. This march, which began at Brown Chapel AME on March 7, 1965, became known as Bloody Sunday. As more than 600 peaceful marchers descended across the Edmond Pettus Bridge, state troopers attacked them with tear gas, billy clubs, and whips. Mrs. Amelia Boynton and Mr. John Lewis (who is currently a U.S. representative from Georgia) were among the injured as a result of this attack on Black citizens. The scene was televised nationwide, effectively expanding the movement from voting rights to human rights.

After Bloody Sunday, SNCC wanted to march again the following Tuesday. More than 450 clergy came to Selma to participate in the next march, on March 9, 1965, which grew to more than 2,000 participants. As Rev. Ralph Abernathy prayed for direction on the Pettus Bridge, Dr. King and others turned around and went back to Brown Chapel because they feared there would be additional violence. However, on March 21, 1965, a final march was sanctioned by a judge and supported by federalized troops. Participants included not only Martin Luther King, Coretta Scott King, Andrew Young, Ralph Abernathy, and John Lewis but also actor Harry Belafonte, singers Joan Baez and Tony Bennett, and thousands of working-class Blacks and

sympathetic Whites. The event peaked with 25,000 marchers from Selma to Montgomery. Though lives were lost, including Rev. James Reeb and Ms. Viola Luizzo, the efforts in Selma were not in vain. Five months later, 9,000 Blacks registered to vote in Alabama after the Voting Rights Act was signed by President Lyndon B. Johnson on August 6, 1965.

On March 7, 2015, thousands returned to Selma to commemorate the passage of 50 years since the signing of the Voting Rights Act in 1965 and to remember the heroism and courage of those who participated in the movement. Speeches from dignitaries, including President Barack Obama, took place on the Pettus Bridge. Ten days later, I took a trip to Tuskegee University to discuss a future National Science Foundation project with colleagues in the College of Engineering. While I was in the area, I visited Selma and Montgomery. Selma was relatively quiet. There were few signs—except for a church marquee announcing the name of a prominent minister as a guest speaker—that there had been a huge rally in Selma the week before. The historic Brown Chapel AME Church sat in the center of an urban housing project. Most notably, despite the attention that had been given to their struggle, the economic conditions of Blacks in Selma appeared relatively unchanged in the 50 years since the historic march. More recently, new ways of disenfranchising voters have emerged.

Since the historic election in 2008, where more than 64% of Blacks cast their vote for President Barack Obama, the harsh reality is that “5.8 million Americans are prevented from voting because of a prior felony conviction, including more than 2 million formerly incarcerated African Americans” (Taylor, 2016, p. 16). In addition to incarceration, voter suppression efforts began in 2012 as a backlash to Obama’s election. Requirements, such as voter identification, were instituted to suppress the vote in poor communities and communities of color. While judges blocked voter suppression laws in Pennsylvania and South Carolina before the 2012 election, voter identification requirements remained in effect in Kansas, Indiana,

New Hampshire, Tennessee, and Georgia (Bronner, 2012). According the Brennan Law Center:

*In the first analysis of its kind in 2018, the Brennan Center's Voting Laws Roundup shows that lawmakers in eight states have introduced at least 16 bills making it harder to vote, and 35 restrictive bills in 14 states have carried over from previous legislative sessions. If passed, the laws would increase restrictions on voter registration and limit early and absentee voting opportunities, among other changes.*⁶

In addition to voter suppression, Republican-controlled legislatures in several states, including Pennsylvania, Maryland, and Wisconsin, used 2010 Census data to revamp voting districts, which resulted in gerrymandering to elect more Republicans to state and national offices (Associated Press, 2018). In January 2018, the Pennsylvania Supreme Court ruled the state's congressional map unconstitutional (Associated Press, 2018). The decision was upheld by the U.S. Supreme Court. Despite America's long and bloody history on voting rights, suppression continues to impact persons of color (Austin, Cardwell, Kennedy, & Spencer, 2016).

Yet, the power of the vote was illuminated in the 2017 state election in Virginia, which resulted in a tie that literally led to a lottery-style drawing to decide who won (Simpson, 2018). Furthermore, Black female voters helped to elect an Alabama Democratic candidate, Doug Jones, to the U.S. Senate in a special election in 2017 to replace Attorney General Jeff Sessions (Fausset & Robertson, 2017). These and other examples show that the importance of the voting process cannot be understated, as literally every vote counts.

The history of voting rights in the United States provides a strong context for teaching mathematics concepts. Mathematics lessons can be blended with social studies to help K–12 students learn and understand our voting history. Stevens and Stevens (2016) developed a mathematics lesson about the

electoral process. They used M&Ms and Skittles to help high school students understand data and statistics through candy elections. Such activities can be used to not only help students understand elections but the voting process as well.

Black Lives Matter

The tragic death of Trayvon Martin in February 2012 left Black America numb. Trayvon was an unarmed 17-year-old boy,⁷ who seemingly did nothing to provoke the encounter with George Zimmerman, who pursued him even after police told him not to do so. Subsequently, a trial based on what many people considered an open-and-shut case turned into a circus in which the victim was characterized as the aggressor. There were three decisions the jury could have reached—guilty of second-degree murder (the actual charge), guilty of manslaughter, or not guilty. Many people expected at least a manslaughter conviction. In the case of Trayvon Martin, justice was not served, as the jury returned a verdict of “not guilty” against George Zimmerman. In response to that verdict, three women—Patriesse Cullors, Opal Tometi, and Alicia Garza—created the hashtag #BlackLivesMatter (Taylor, 2016). After the grand jury in St. Louis County, Missouri, decided not to indict Darren Wilson on November 24, 2014, for the death of Michael Brown in Ferguson, Missouri, the hashtag became a movement (Chang, 2016; Taylor, 2016). With the deaths of Tamir Rice in Cleveland and Eric Garner in Staten Island, patience with the criminal justice system ran out, and anger that had been simmering for years erupted into a national outcry over the blatant inequities of the U.S. judicial system.

Although state violence in the form of police shootings has been a fact of life for Black America, the image of Michael Brown, a young, unarmed Black man shot multiple times, even as his hands were raised, and his body left in the street could not be reconciled. Within a few months, “thousands of college, high school, and even middle school students began organizing and participating in die-ins, walkouts, marches, and other forms

of public protest” (Taylor, 2016, p. 173). Congressional aides protested in Washington, DC, too. In December 2014, there was a protest and die-in at the University of Wyoming, where I worked. I listened to student and faculty speeches and then marched with about 100 others and participated in a die-in. However, our work did not stop there.

Although I was living and working in Wyoming, the death of Michael Brown near my hometown of St. Louis was surreal. The expletives allegedly uttered by Officer Darren Wilson to Michael Brown and his friend to get out of the street were familiar as I recalled my own negative encounters with St. Louis police officers when I was a teenager in the 1970s. In response, I called on three female colleagues who met with me to address diversity issues at the University of Wyoming. As a result of this meeting, a grassroots organization called the Committee on Women and People of Color (CoWPoC) was formed. This group met with university administrators and Department of Justice staff in Denver, Colorado, to initiate the hiring of a chief diversity officer. In addition, the committee—which consisted of faculty, staff, and students—sponsored several events, including distinguished speaker events and banquets to recognize teaching, research, and service among diverse faculty, staff, students, and community members.

#BLM is not simply about police brutality. It uses the decentralized leadership and local chapter organizing methods of the 2011 Occupy movement to speak to all issues related to human dignity while asserting the value of Black life (Taylor, 2016). The issues of racial profiling, health and wellness, water quality, and equal housing are among the issues included in their platform. These issues, like those discussed previously, can provide a potent backdrop for teaching mathematics for cultural relevance and social justice.

Racial Profiling

Teachers of mathematics can build student awareness of #BLM by using data collected on traffic stops as well as policies like

Broken Windows and *Stop-and-Frisk*. *Broken Windows*, or “order maintenance policing,” began as a law enforcement policy in New York City in the late 1990s (Hill, 2016, p. 41). This policy focused on petty crimes, which law enforcement officers believed would lead to large-scale crimes (Hill, 2016). *Stop-and-Frisk* tactics (ruled unconstitutional in 2013) were used to stop, question, and frisk individuals suspected of a crime. In New York City, there were more than 4.4 million stops from 2004 to 2012, but those who were stopped most often were Black (50%) and Latinx (30%) (Hill, 2016). *Stop-and-Frisk* was also used in Los Angeles, California, with even greater frequency.

Himmelstein (2013) developed a mathematics lesson that used *Stop-and-Frisk* as the basis for learning about central tendency. Students compared stops in different boroughs in New York City and created histograms and box-and-whiskers plots to examine the number and the percentage of stops for different racial groups in proportion to their representation within the general population. Such mathematics exercises provide high school students with the opportunity to engage in quantitative as well as qualitative data as they match data to their personal experiences in culturally specific ways. Notably, the data revealed that Black and Latinx citizens had the highest number of stops, but White and Latinx citizens had the highest percentage of stops in 2010.

Similarly, Gutstein (2013) presented the mathematics lesson “*Driving While Black or Brown*” to his middle school students in Chicago, Illinois. Based on demographics for Chicago, students used probability with colored cubes to explore what the percentage of traffic stops should be for people of four different ethnic backgrounds (African-American, White, Latinx, and Asian). Students then compared the actual number and percentage of traffic stops by ethnicity. Teachers in other towns and cities may encourage students to collect similar forms of data. Findings, such as those in Ferguson, revealed that 95% of traffic stops involved Black drivers (Hill, 2016). These data can be used as evidence of racial profiling.

In August 2014, I was pulled over by local police on a residential street in Laramie, Wyoming. The White policeman, who was wearing a bodycam, stated I was speeding and that he clocked me going 11 miles over the speed limit. I replied, “I do not think I was going that fast.” The officer went to his car to check my license and insurance. When he returned, he asked if I was from Laramie. I replied, “I live right around the corner, and I believe you pulled me over because of my race.” Surprised by my response, he denied racial profiling and stated he was giving me a ticket for speeding, but I had a discount for wearing my seatbelt. I responded, “I will see you in court!” Two months later there was a court hearing. To prepare for the hearing, I recalled that I had a receipt from the local Walmart for cleaning items. The receipt showed the time I left the store, and the ticket showed the time I was pulled over. The elapsed time was about 10 minutes, which was four minutes longer than the six minutes MapQuest determined it would take me to get home. I used this evidence to challenge the ticket. The district attorney objected to this evidence, stating that we could not be sure Walmart cash registers kept the correct time. However, the rate problem itself was flawed (Wu, 2014).

Like most textbook mathematics problem, the rate problem described above assumed I was traveling at a constant speed rather than an average speed. Even if I had been traveling slower initially on the route home from Walmart, I could have in fact been speeding on the portion of the route where I was stopped by the policeman. Furthermore, the time it took to make a left turn out of the Walmart parking lot and the number of red lights encountered were variables that ticked the time away. Nevertheless, using the rate problem ($\text{rate} = \text{distance} / \text{time}$) was an effective argument because it caused the judge and the district attorney to think more deeply about my racial profiling claim.

The officer used video from his dashcam and data from the radar gun as evidence of speeding. I pointed out that the video also showed the officer raising the radar gun after I passed him

in my car. I asked the officer if he pulled me over because I was Black or because I was speeding. The district attorney, of course, objected to this question. I rephrased by asking the officer if he pulled me over because he saw *me* driving or because *I was speeding*. Of course, the response was the latter, but the judge, who was a woman, gave some thought to my argument. However, because there was no proof that the radar gun had malfunctioned, the judge ruled in favor of the officer and upheld the fine. Nevertheless, the judge stopped the proceedings and did not hear the next case until she had spoken with the officer. I believe she warned the officer about racial profiling. Subsequently, while I had the right to appeal the judge's decision, I decided to pay the fine to move on with my life.

In May 2015, however, I was absolved of liability for a parking violation. I was fined for parking in a handicapped space even though I had a temporary handicapped decal that was issued by the University of Wyoming. The officer had just placed the ticket on my windshield when I returned to my car after attending a meeting. Hobbled with an orthopedic shoe, I asked the officer why I was ticketed. The White male officer said the parking space was reserved for handicapped decals issued by the state but not the university. My disadvantage was not knowing the difference between the types of handicapped signs on the campus. My argument in this particular instance was sound, however, because there was no way of knowing which handicapped signs applied to my decal. The order for dismissal of the citation read: "dismissed as it is in the best interests of justice."

The foregoing mathematics lessons and personal accounts may be used to engage students in problem solving, reasoning, and logic to make mathematical arguments (Gutstein, 2013; Himmelstein, 2013). Students in middle and high school should be encouraged by these examples to consider how they might use mathematics for social justice to resist racial profiling and other forms of state oppression.

“I Can’t Breathe!”

In addition to racial profiling, #BLM brought state violence and public health to the forefront of American consciousness with protests over the death of Eric Garner in Staten Island, New York, in July 2014. Mr. Garner was confronted by two White police officers, Justin Damico and Daniel Pantaleo, for selling loose cigarettes (Hill, 2016). When he refused to comply with their instructions, he was put in a choke hold and thrown to the concrete sidewalk with his head pinned to the ground (Hill, 2016). Cell phone footage revealed that Eric Garner repeated the phrase “I can’t breathe!” 11 times before losing consciousness. For #BLM, his death (as well as the death of his daughter in December 2017) threatened the right to thrive (Austin, Cardwell, Kennedy, & Spencer, 2016). Thus, public health and attention to environmental hazards that inhibit air quality become a basis for TMfSJ.

Prior to the #BLM, Akom (2011) linked educational outcomes to community health issues, specifically those related to the presence of lead and asbestos in housing units and the presence of polychlorinated biphenyl (PCB)—a toxic organic pollutant—in poor communities. He examined the relationships between race, space, place, and waste in what he called eco-apartheid. Akom (2011) concluded that “health disparities have led to the disproportionate exposure of Black people/people of color to the effects of concentrated poverty,” and he linked environmental hazards (i.e., lead and asbestos) to “depressed academic performance” (p. 833). Akom inspired youth to study these links by using the Geographic Information System (GIS) and ground-trooping (i.e., collecting evidence on the ground) to obtain data on biohazards in an effort to increase community awareness and advocate for environmental justice. Data can also be collected on the Air Quality Index (AQI) in specific communities. The Environmental Protection Agency (EPA) has a website that students can use to assess real-time AQI data by zip code.⁸ For example, the site showed that

Camden County, New Jersey, had a moderate air quality rating of 58 at 12:00am on January 29, 2018. Thus, teaching mathematics for environmental justice can motivate students to learn while providing them with lifelong skills that have a direct bearing on community health.

Flint Water Crisis

Public health is dependent upon clean water and healthy food supplies. The predominantly Black community of Flint, Michigan, with more than 40% of its residents living in poverty, suffered exposure to massive amounts of lead from old lead pipes that contaminated the drinking water in August 2014 (Hill, 2016, Oosting, 2016). The toxic levels of lead that thousands of children in Flint were exposed to is incalculable, revealing to the nation and the world the injustices that poor urban communities continue to endure (Hill, 2016). Michigan State University (MSU) colleagues implemented a mathematics program in Flint to address some of the educational inequities that exist there. The Access, Agency, and Allies in Mathematical Systems (A3IMS) project used a practice-based model of professional development that focused on creating systemic reforms through collaborative communities in which mathematics teacher educators, mathematics teachers, and students worked together to support opportunities to learn (Larnell et al., 2016). Teachers, with the help of graduate students at MSU, used the Flint water crisis to develop a mathematics lesson for second-grade students to determine the amount of bottled water the class needed each day (Plumb, Roberts-Caudle, Harper, & Jones, 2017). Rather than shying away from topics like these, the lesson revealed that young children have the capacity to investigate and learn from real-world complexities, such as water quality, that impact their lives (Plumb et al., 2017).

Housing Inequality

In 1968, the Fair Housing Act was passed to end discrimination against African-Americans and other underrepresented groups

in housing, but ongoing residential segregation, which has an impact on the racial demographics of neighborhood schools, persists (Rothstein, 2017). Investigations into housing practices revealed “restrictive covenants on real estate and the proliferation of community-destroying interstate highways to create geographic barriers between whites and blacks” contributed to school segregation (Ladson-Billings, 2017, p. 83). Housing developments (i.e., Levittown, New York) favored working-class White veterans who were able to accumulate wealth through homeownership over time (Ladson-Billings, 2017; Rothstein, 2017), while subprime loans eliminated wealth for many Black homeowners during the 2007 economic downturn (Taylor, 2016). For example, in Levittown, New York, homes that originally sold for \$6,000 in the 1950s were worth more than \$500,000 in 2017. In comparison, the New Jersey townhome that I purchased in July 2003 for \$212,500 was worth \$167,200⁹ in July 2018. Negative equity and foreclosures erased most of the wealth that Black families accumulated in their homes during the 2007 housing market bust (Taylor, 2016). These lower values have also had an impact on school funding, which continues to be supported by residential property taxes (Ladson-Billings, 2006). Lower property taxes mean lower revenue for school improvements and teacher salaries. Lower revenues limit the school district’s ability to provide adequate curricular resources and to recruit and retain high-quality teachers. Thus, a cyclical pattern (i.e., segregated housing, inexperienced teachers, failing schools, etc.) is created that contributes to structural inequities and educational disparities (Ladson-Billings, 2017).

Mathematics lessons that investigate instances of race-based discrimination in home buying, such as “*Home Buying While Brown or Black*” (Gutstein, 2013), have examined data on mortgages. In one lesson on fractions and percentages, middle school students discovered that African-Americans in Chicago were five times more likely to be rejected for mortgages than Whites, and Hispanics were three times more likely to be

rejected for mortgages than Whites. Middle school students (Gutstein, 2013), as well as teacher candidates (White, Crespo, & Civil, 2016), have debated whether such practices are racist. To address their concerns, additional mortgage data in myriad communities across different populations are needed to assess the impact of mortgage lending practices at different periods throughout U.S. history.

As the Levittown example revealed, families can accumulate wealth through home buying. Yet, declining property values, foreclosures, gentrification, and other factors have limited the accumulation of wealth for many Black and Brown families (Taylor, 2016). Studying these patterns, as well as learning about mortgages and interest rates, provides middle and high school students with opportunities to learn mathematics for empowerment.

Black Firsts in Science and Mathematics

#BlackLivesMatter is a movement of grassroots activists that want to promote life and wellness in the Black community. Thus, any discussion of the movement is incomplete without the acknowledgment of Black men and women throughout history who have made significant contributions to society at large. In 2009, the U.S. Department of Education reported that 4.5 million African-Americans living today have earned undergraduate degrees and 100,000 (i.e., 0.026% of the population) have earned doctoral degrees. In 2010, the National Science Foundation reported that 2,221 African-Americans had earned doctorates, which was more than any single previous year. Furthermore, African-Americans continue to break barriers. Like the women in *Hidden Figures* (Shetterly, 2016), there are numerous African-Americans in the fields of science, technology, engineering, mathematics (collectively referred to as STEM disciplines), medicine, and education. Yet, many of their accomplishments and successes have been overlooked or obscured by the passage of time. Learning about Black firsts reinforces the concept that teaching is a

political act (Ladson-Billings, 2009). The stories of six men and women who were first or early to make a difference in some of these fields are recounted below.

St. Elmo Brady (1884–1966)

Born in Louisville, Kentucky, Dr. Brady was a graduate of Fisk University in Nashville, Tennessee, and the first African-American to earn a doctorate in chemistry (University of Illinois) in 1916.¹⁰ He worked with Dr. George Washington Carver at Tuskegee Institute in Alabama and headed chemistry departments at Howard University (Washington, DC) and Fisk University. He contributed to research on the chemistry of polynuclear hydrocarbons and organic medicinals at Fisk University where he retired in 1952. He also established a chemistry department at Tugaloo College in Mississippi after he retired from Fisk.

Martha Euphemia Lofton Haynes (1890–1980)

Born in Washington, DC, Euphemia Lofton Haynes was a graduate of Smith College (Massachusetts) and in 1943 the first African-American woman to receive a PhD (Catholic University of America, Washington, DC) in mathematics. She was an educator who taught in the Washington, DC, public schools for 47 years. She taught mathematics at Armstrong High School and Dunbar High School, where she also served as chair of the Mathematics Department.¹¹ After retiring from the school system in 1959, Dr. Haynes established the mathematics department at Miner's Teacher College (renamed the University of the District of Columbia).

Bessie Blount (1914–2009)

Born in Hickory (i.e., Chesapeake), Virginia, Mrs. Bessie Blount Griffin was a physical therapist who patented two inventions to help disabled WWII veterans who were amputees—the feeding tube and the disposable emesis basin. The Veterans Administration was not interested in her inventions. As a result, the feeding tube patent was donated to France and used in French

hospitals, and the patent for the basin was sold to Belgium, where it is still used in hospitals today.¹² Later, when she was about 55 years old, Bessie Blount went into law enforcement and became a forensic scientist. In 1977, she became the first African-American woman at Scotland Yard in England.¹³

Ed Dwight (1933–)

Ed Dwight was selected by the Kennedy administration as the first African-American astronaut candidate in the U.S. Born in Kansas City, Kansas, he graduated with a degree in aeronautical engineering from Arizona State University. Mr. Dwight served as an Air Force test pilot, achieving the rank of captain.¹⁴ Today, Mr. Dwight lives in Denver, Colorado, and is renowned as a sculptor. He was honored with a lifetime achievement award at the University of Wyoming in 2015.

Jessie Eugene Russell (1948–)

Born in Nashville, Tennessee, Mr. Russell majored in electrical engineering and graduated from Tennessee State University in 1972. He is known as the father of the cell phone. Having worked for Bell Laboratories, Mr. Russell patented and continues to invent technology related to broadband wireless networks, technologies and services, commonly known as 4G.¹⁵ Presently, Mr. Russell is the chairman and CEO of incNETWORKS in New Jersey.

Aprille Ericsson-Jackson (1963–)

Born in Brooklyn, New York, in 1995 Dr. Ericsson-Jackson became the first African-American woman to earn a doctoral degree in mechanical engineering (Howard University). After completing a master's degree at Howard in 1991 and a bachelor's degree in aeronautical/astronautical engineering from the Massachusetts Institute of Technology in 1986 (Goad, 2016), she began a career as an engineer at NASA Goddard (Maryland) in 1992. Dr. Ericsson-Jackson is also the first African-American woman at this agency with a doctoral degree in mechanical engineering.

Summary

While the #BLM movement began as a reaction to state violence against people of color, it has grown to be so much more. Quality of life in health, housing, education, and labor have become focal points in #BLM. Data provide evidence for conducting research on myriad topics that middle and high school students will eagerly engage in during mathematics classes. They would be surprised to learn that on March 2, 1955, in Montgomery, Alabama, a 15-year-old student named Claudette Colvin was the first African-American to be arrested for refusing to give her bus seat to a White woman. Although her story is obscure, she was a pivotal witness in *Browder v. Gayle* in 1956 (Hoose, 2009). In examining the history of topics from voting rights to the election process and from wages to mortgages, the sky is the limit for what underrepresented students can learn about empowerment and the struggle for social justice using mathematics as the basis. However, teachers should be sensitive to marginalized students' emotional and psychological well-being when discussing social justice topics, and teachers should be flexible in regard to the choice of topics to ensure that students have a safe space to voice their opinions and concerns.

African-Americans are brilliant, as the snapshots of scholars listed above have shown (Leonard & Martin, 2013). African-Americans have made numerous contributions to social and scientific communities that include original American music (e.g., gospel, blues, and hip-hop) and notable STEM contributions. K–12 teachers who wish to teach mathematics for social justice (TMfSJ) can shed light on these achievements as they engage in culturally specific pedagogy.

Chapter 8 Discussion Questions

1. What arguments can teachers use to justify the importance of teaching mathematics for social justice to K–12 students?

2. What strategies can teachers use when students (i.e., Gutstein's mathematics classroom in Chicago) fail to see discrimination in housing or some other set of data?
3. How can teachers help students realize that #BLM does not mean that other life is not valued?
4. Given that teaching is a political act, how might teachers support students' efforts to engage in social activism?

Notes

1. DNA results obtained from 23andme.
2. Fisk University, John Hope and Aurelia E. Franklin Library, Special Collections, St. Elmo Brady Collection.
3. Miscellaneous Series Bulletin, Volume, 7; Volume 9–23 (U.S. Printing 1893).
4. Fisk University, John Hope and Aurelia E. Franklin Library, Special Collections, St. Elmo Brady Collection.
5. Division of Political History, National Museum of American History, Smithsonian Institution.
6. www.commondreams.org/newswire/2018/01/22/new-analysis-voter-suppression-laws-concern-2018-though-many-states-looking.
7. The notion that he was a child is significant since there is evidence that Black children are often pathologized and tried as adults in the criminal justice system.
8. https://airnow.gov/index.cfm?action=airnow.local_city&zipcode=08081&submit=Go.
9. Data obtained from Zillow.com.
10. <https://chemistry.illinois.edu/node/193>.
11. www.biography.com/people/euphemia-lofton-haynes-21465777.
12. <https://americacomesalive.com/2016/02/11/bessie-blount-griffin-physical-therapist-and-inventor>.
13. www.myblackhistory.net/Bessie_Blount.htm.
14. https://en.wikipedia.org/wiki/Ed_Dwight.
15. <http://blackinhistory.tumblr.com/post/76170627429/jesse-eugene-russell#.WnToboJG2t9>.