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High School Mathematics: A Venue For Political Resistance To White Supremacy

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HIGH SCHOOL MATHEMATICS: A VENUE FOR POLITICAL RESISTANCE TO WHITE SUPREMACY

by

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Introduction

Overview

Mathematics education in the United States is a white supremist structure that needs to be dismantled and restructured. The system is designed and perpetuated through inequitable access, the dehumanization of students, and the emphasis of the individual over the collective. Mathematics educators are exclusively educating one section of our students. These students are the elite and given exclusive access to a *Mathematics Members Only Club*. Members are afforded opportunities that will secure their financial status and the success of their future generations. The remaining students are left to take remedial mathematics courses in college, costing valuable resources of time and money, but not count as credits towards their college degree.

This inequity is exacerbated for Students of Color. The poorest white students have a higher proportion of mathematics proficiency compared to our wealthiest Students of Color (Minnesota Report Card, 2017). Race has something to do with it. Mathematics classrooms in the United States perpetuate systems of White Supremacy. They are treated as politically neutral zones despite everything about mathematics education being political. However, the vast majority of mathematics classrooms across America are absent of a political and racial context and dialogue. Many educators are reticent to engage these topics into their curricula and classrooms, as they feel ill prepared to discuss issues of race and class with their students. We must see the mathematics classroom as a vital place to discuss and analyze racism, power, and privilege. Society is in great need of a future generation that is equipped to take on the challenges created by our unjust systems and unbalanced power structures.

Educators need to do more than teach their content. We have an obligation to provide an education to our students that develops their critical consciousness and their capacity to actively engage in justice work to better their community. We have a responsibility to demonstrate, and make known, each student's value in our community.

In this chapter, I will delve into how my educational journey offered me an opportunity to examine my whiteness. This journey highlights the reality of inequitable access to rich mathematics curriculum. It analyzes the impact of dehumanizing students, and the role of the educator. It will further posit, that by valuing the individual over the collective, current mathematics education keeps unjust systems in place. Each impactful moment provides insight on how I developed the critical aspects of my project. Every failed attempt and moment of progress fueled my insatiable need to find an answer to my research question: *How can mathematics education be restructured to dismantle White Supremacy in the mathematics classroom, improve content mastery, and increase student agency?*

My refusal to advance the status quo established by systems of White Supremacy drives my passion. I strive to see every single student in my classroom as a three-dimensional human being. It is essential to support my students in their agency. I commit to treat my students as sacred, and with awe. I need to be a curious teacher with my eyes wide open. My project provides pathways to do all of these things. It disrupts the status quo of mathematics education, and helps other educators in their relentless pursuit to do the real work in mathematics education—applying mathematics to better understand our world.

The Model Student

Applying for college is an ego boost for model students. Each component of the application process affirmed my intelligence, altruism, poise, maturity, trustworthiness,

dependability, persistence, tenacity, and capacity to lead. Each completed application reminded me that I had worked hard in high school and each acceptance letter confirmed that I had deserved my accolades. The excitement in everyone's voice as they inquired on my plans after high school only further legitimized my success. The University of Chicago, the number one nationally ranked university for Economics, accepted me, and I was in. I was going to major in Economics.

The transition from high school to college changed me as a human being; the University of Chicago changed my worldview. Nationally recognized professors taught to class sizes of twelve students or fewer. My sociology professor played an integral role in designing the collection of data when AIDS epidemic first appeared in the United States. The university exposed me to content that I never even knew existed. The complexity and depth of the courses pushed me to become an even better student. My focus was no longer about being a model student, but becoming an enthusiastic and curious learner.

American Dream Interrupted

Despite some struggles in my transition from high school to college, I persisted. My parents were proud of me. But, I was not. The discordant emotional journey I was taking fostered anger inside of me. An anger I found difficult to diagnose. My understanding of the world was shifting. Any model student at my high school would not measure up to the average student at the university. In conversations with other classmates, I became acutely aware of my limited vocabulary. No more writing awards, instead I was given a dictionary and told to use it every time I tried to write a paper. I experienced anxiety and the pressure of performing well on high-stakes tests. Up until this point, I never questioned my acceptance at the university, but now, it was all I could think about.

Success is relative. My high school teachers knew this and told me to prepare myself to fail. They had not prepared me to go to an elite university because they were teaching kids that "did not go to those schools." Most of my teachers identified and focused on my deficits and the deficits of my classmates.

The incongruity of my high school praises and my college shortcomings demanded a deep self-reflection. I misunderstood my success. Evidence for the dissonance I would experience in college was present the entire time, yet I was blind to it. My acceptance letter from the University of Chicago noted my test scores were not on par. My ACT score was below the thirty earned by more than ninety-percent of those accepted at the University of Chicago. My disillusionment of success allowed me only to focus on my test score, the highest in my peer group.

There are many underwhelming features of low-performing high schools: low enrollment, poverty, low expectations, high dropout rates, poor attendance, etc. The worst feature of a low-performing high school is not knowing when you are attending one. Extra-curricular participation, academic honors, and sports are open to everyone. Tryouts and application submissions are not required because most students do not qualify to participate. Focusing only on roles, awards, and achievements exposes privilege, yet it ignores equity in access and the structure that is in place which determines who is allowed in and who is not. The structure made it easier for me to be a model student.

My privilege did not just come in the form of shortcuts towards success. It also showed up in the form of elitism. While in college, both of my jobs working in the Chicago Public School District, engaged my deficient view of the underprivileged. The children needed to be "saved." I became my high school. Students were viewed and treated as if they

lacked something at home, and it was my responsibility to fill this void. The students had more of an impact on my life than I could even dream of having on theirs. It was their assets, which were present prior to working with me, which made them successful. They showed me the importance of seeing and recognizing their humanity. There were so many things about these children that could go unnoticed and would be devalued by mainstream society. The students grounded me.

My acceptance to University of Chicago was predicated on hard work, or so I thought. Each day, I began to realize that was not what dictated my spot and other students' spots at this school. When it comes to succeeding at life, something much bigger than a person's drive and ambition is at play. I recognized inequities everywhere I went, struggled to articulate what I was feeling or experiencing, but I could not communicate because I did not have a language to discuss privilege, power, or race in a meaningful way. I did not acquire this language for several years after I graduated.

Many students in our public schools today are coming across these same experiences. Students need to be taught and surrounded with a language that will allow them to have important and engaging dialogues which will enhance their understanding of their own identity and the global world they reside in. Moreover, we need citizens, students, engaged in the work necessary to disrupt discriminatory behavior, structures, and systems that violate their or other people's humanity—be it politically, professionally, or socially.

Time to Teach

Despite my initial inclination to avoid education, I found myself enrolling in Hamline's Master of Arts in Teaching program six years later. I wanted to teach; more importantly, I wanted to work with students that were not being served in our public schools.

To be clear, my intention is not to "save at-risk students." My purpose is to empower students who are marginalized and dehumanized in our current educational system.

I was angry my first two years at the University of Chicago. The American Dream was instilled in me throughout my childhood. If you worked hard, you could accomplish whatever you wanted; I truly believed it. However, the absurdity of the American Dream became more evident every single day. I was living with an enormous amount of privilege. This is when I knew I had to get involved in the educational system. The leaders responsible for making change in our world were my classmates at the University of Chicago. They had an unchallenged, isolated, perspective of the world. They have the responsibility to make change, but are unable to make the changes necessary for equity and equality for all people. Many of my classmates held deficit views similar to that of my high school educators. It was also in this perspective that I began to identify my white privilege and the harm it has on people.

Why Mathematics?

I wanted to teach mathematics, the most commonly hated subject in high school. Mathematics classes at the University of Chicago justified the addiction to engage in challenging problems. I loved the feeling of accomplishment after spending hours on a single problem, struggling, making connections, and then finally figuring it out. This was a difficult feeling to convey to my friends. My friends and family had very different experiences with mathematics and were repulsed by the notion that it could be a satisfying experience. Although I understood this disconnection, I despised it.

Educational systems are unjust when they allow some students to go to college and access beautifully complicated mathematics and never offer the opportunity to other students.

Teaching mathematics is a political activity unknown to the majority of our population. The structures and policies that guide students' experiences and careers in mathematics perpetuate systems of oppression and racism in our schools. The connection of mathematics and politics is the key in engaging in dialogue about race, power, and privilege with students. However, how do I make this connection and still meet the pacing and curriculum demands of a public school district? I needed to figure out how to be an agent of change in the classroom. I needed an answer to my research question: *How can mathematics education be restructured to dismantle White Supremacy in the mathematics classroom, improve content mastery, and increase student agency?* I needed to build positive mathematics experiences that honor students, help them discover themselves, and exemplify the ways the world works.

Praxis vs. Theory

I vividly remember sitting in my teacher preparation classes promising myself that I would implement all the innovative and promising theories I had been learning about including culturally relevant pedagogy, student centered classrooms, progressive models, etc. Also I very clearly remember how quickly I ditched these strategies and started teaching the way I remember being taught. New teachers face many pressures including pacing, behavior management, student engagement, district mandates, and student achievement. The requirements of teaching are impossible and can be paralyzing. Unsurprisingly, I received the same results that my previous educators did. Like most new educators, I was committed and energetic about making an impact on student learning, but I lacked support, strategies, and a plan that would enable this to happen.

My passion for getting into teaching was still inside of me but was not showing up in my teaching. Students are required to take mathematics and many are coming to high school

with horrific memories and experiences in the mathematics classroom. Even if students come with ability and skill, they often have low self-confidence and esteem in regard to the content. This contributes to the lack of engagement and risks students are willing to take in the class. I realized, soon after, that teaching the way I was taught was no longer an option.

Hamline offered a short but intense transformative program for urban teachers. I was very judgmental of other teachers and their resistance in implementing a critical curriculum that would help them meet the needs of all their learners. They, of course, were teaching content that lent itself more easily to social justice topics and critical perspectives. I, on the other hand, was free from these criticisms because I taught mathematics. Then the beginning of my "epiphany" happened. My professor called me out in front of the class, as I was being condemnatory of other teachers. She said, "And what exactly are you doing?" And all I could say was "nothing."

Failed Attempts

I had to start somewhere. To increase student engagement, I wanted to design projects that would provide a new perspective on mathematics. There were many activities and ideas for middle school mathematics that incorporated social justice topics. However, I was determined not to "dumb-down" the mathematics in order to incorporate social justice topics. Near the end of the year I tried out a two-day project (Math, Maps and Misrepresentations) from the first edition of *Rethinking Mathematics*. The reaction of my students to the project was underwhelming. I felt like I had given them gold, and all they wanted to do was give me responses they thought I was looking for. Did they not care about the message behind the mathematics? Did they not feel bamboozled by their previous educators? Did they not want to learn more about this sort of thing? All my reflecting was back on the students. It took a

minute before I started questioning what I had done that contributed to the lackluster results. Once I began to question my role, I realized that I had never prepared the students to really delve into the lesson. The foundational work required in discussing issues of race and power were not present in my classroom. This experience taught me the true importance of building community, relationships, and language with my students prior to incorporating a critical pedagogy.

The Human Rights Center at the University of Minnesota encouraged me to keep developing a critical mathematics curriculum. As the next school year went on, I found it incredibly difficult to come up with a project worthy of their Racial Healing grant. I was determined to incorporate course level mathematics that were tied to state standards and connect them to real issues in our community. Time kept passing and I had no project. Eventually I realized students needed to decide for themselves what they were interested in and how to incorporate mathematics into their project. The students created a series of public service announcements that were driven by the application of mathematics.

The Epiphany

This project taught me two incredibly meaningful things. These two things were the cornerstones of my understanding of how mathematics and social justice work hand-in-hand. Student voice was essential. This is something I knew to be true but never successfully incorporated it into my classroom before. Students invested in this project because they decided what they were going to study and they decided how they would communicate this to their audience. Secondly, I found out how interested students truly are in their community. Their community means a lot to them and they want to contribute in significant ways. All of

the students demonstrated bravery and courage throughout this process. I attribute crucial changes to my teaching style, philosophy, and curriculum to these students.

Conclusion

In this chapter, I discussed the three main structural issues with mathematics education. I have shown how my experiences in high school and college have driven my relentless pursuit to answer my research question: *How can mathematics education be restructured to dismantle White Supremacy in the mathematics classroom, improve content mastery, and increase student agency?* My project aims to create a curriculum that honors students' humanity and the community. In addition, my project examines structures and systems that will be transformed to create more equitable experiences for students. Chapter two will provide evidence for the three main structures supporting White Supremacy in mathematics classrooms across America: inequitable access, the dehumanization of the student, and the emphasis of the individual over the collective. Furthermore, I discuss how to interrupt and transform these structures in the classroom, and explore what brain research tells us about our social nature. Chapter two examines research about culturally relevant teaching practices and Critical Race Theory and the impact on educators and institutions. Chapter three provides a framework for my project and a justification for each component of the framework. Chapter four discusses the scope of the impact, implementation challenges, and the future of the project.

CHAPTER TWO

Literature Review

Introduction

The teaching of mathematics in the United States is biased, unjust, and racist. It pretends to be a politically neutral subject despite its inherent white supremist structures and systems. Issues of power, privilege, and race show up in many forms and create intense inequities for students across America. Mathematics education is a hyper-individualized learning structure despite the social needs of our brains. The mathematics classroom is designed, and succeeds, at labeling and protecting the elite of society. Mathematics education in America dehumanizes our students. Structural racism in mathematics education runs deep and requires immediate change. *How can mathematics education be restructured to dismantle White Supremacy in the mathematics classroom, improve content mastery, and increase student agency?*

This chapter analyzes the social nature of the human brain and how current United States culture conflicts with our need to be connected. More specifically, we will examine three main structures of social disconnection in mathematics education that sustain White Supremacy. Mathematics education can be a venue for political resistance to social disconnection. Therefore, this chapter will review research that provides direction in interrupting systems of racism and oppression including Critical Race Theory and culturally relevant teaching.

Social Brain

Social Connection. Matthew Lieberman's (2013) book *Social*, explains that humans are hardwired for social connection. Our need for social connection is a necessity for survival

and one way it is demonstrated is when humans run to crying babies instead of running away (Lieberman, 2013). Lieberman argues that our happiness and success in life has very little to with money and everything to do with our social connections. Lieberman's brain research indicates that many components of life improve as we become more social, including our happiness, physical and mental health, productivity, cognitive ability, thinking, decision-making, and more (2013).

Cacioppo and Patrick (2008) agree with Lieberman and have found social connection as a necessary means to reach our full potential. They discuss how the neural wiring of our brains reflects the importance of social connections. Brain scans from fMRI (functional magnetic resonance imaging) studies show that our brains respond to pictures of humans differently than any other objects (Cacioppo and Patrick, 2008). They explain, "these bonds are the centripetal force that holds life together" (Cacioppo and Patrick, 2008, p. 10). Cacioppo and Patrick believe social connection regulates our physiological and emotional health because social experiences impact our neural and hormonal signals (2008). More importantly, they believe a socially connected person extends beyond himself or herself. Socially connected people are in sync with their environment and feed off of each other's "harmonious balance" and become even healthier (Cacioppo and Patrick, 2008). Social connection is not just about keeping one person happy but promoting the happiness within the community.

Our interest in the social world starts at infancy and continues to dominate our brain throughout our adult lives. The social cognitive region is the brain's "default network" (Lieberman, 2013, p. 19). When our brains have down time from performing cognitive tasks, it immediately returns to thinking socially. In fact, the human brain devotes all of its "free-

time" to practice social cognition and this has been shown to exist in two-day old infants (Lieberman, 2013). Essentially, the human brain is hardwired for social connection in that it develops the social cognitive from birth and continues throughout adulthood. Lieberman's, Cacioppo's, and Patrick's work are vital for building a stronger, healthier, and happier society.

Social Disconnection. The human impulse for social connection is profound. Social disconnection is detrimental to our being. Lieberman's research indicates that our brains react to social pain the same way it reacts to physical pain (2013). His research with fMRI (functional magnetic resonance imaging) showed that when a person experienced pain (social or physical) there was more activity in the dACC part of the brain. In fact, when analyzing data it is impossible to distinguish which data set was generated from physical pain and which one was generated from social pain (Lieberman, 2013).

Lieberman discusses pain and its intense connection with survival. Pain is a specific response to a basic need not being met (Lieberman, 2013). Humans experience pain when they are hungry, thirsty, or injured. The pain is a signal to the brain to attend to the unmet need. Lieberman goes on to explain that our social connection is a basic need for survival and pain is a necessary signal to the brain there is a "threat to one of our basic needs" (2013, p. 59). Social connection is a basic and fundamental need for all humans.

Cacioppo and Patrick agree with Lieberman in that pain (physical and social) contributes to our survival as a species (2008). They discuss our need for social pain as a stimulus to protect humans from isolation. Human survival was dependent on social connections for both safety and reproduction. Cacioppo and Patrick explain that social pain is a necessary prompt to engage humans in building and repairing social connections, even

when it does not serve our immediate need. They believe social pain allows humans to prioritize our social connections and allow humans to look beyond themselves (Cacioppo and Patrick, 2008).

Drinking water and eating food is essential to our survival. Based on the instinctual behavior of our brain, Lieberman concludes humans' need for social connection is also essential for survival (2013). Moreover, social pain, in addition to dehydration and malnutrition, can have devastating impacts on physical and mental health. Cacioppo and Patrick found that social disconnection increases perceived stress (2008). In one of their studies, they found lonely people perceived stressors to be more severe even though they were facing essentially the same stressors as their non-lonely counterparts. Kent Harber (2008) studied the same outcome in *Social Support and the Perception of the Geographical Slant*. Harber had participants in the study judge the steepness of a hill. Participants who were alone perceived the hill to be steeper compared to participants who judged the hill with a friend at their side (Schnall, Harber, Stefanucci, and Proffitt, 2008).

Cacioppo and Patrick found that people experiencing loneliness had impaired health, executive function, creativity, and energy (2008). Social disconnection impacts executive function; resulting in chronic health conditions, elevated blood pressure, depression, and anxiety. They argue diminished executive function results in loss of self-regulation and decreased lifespan (Cacioppo and Patrick, 2008).

Social Brain & Learning. Social connection is an essential need for all human beings. Social inclusion improves happiness and health, whereas social isolation has devastating impacts on a person's well being. The purpose of educational institutions is to educate students and increase academic growth. However, teachers know that social needs of

a student often compete with their academic objectives. Understanding the social nature of our brains is fundamental for creating stronger, healthier and more productive mathematics classrooms across our nation.

In every teacher education course across America we learn about Maslow's hierarchy (Maslow, 1943). Students' basic needs (food, water, warmth, rest) must be met before learning can take place in our classrooms. Lieberman's research indicates that social connection is also a basic physiological need (See Figure 1) and would adjust Maslow's structure (2013). It is critical that educators have an accurate understanding of the social

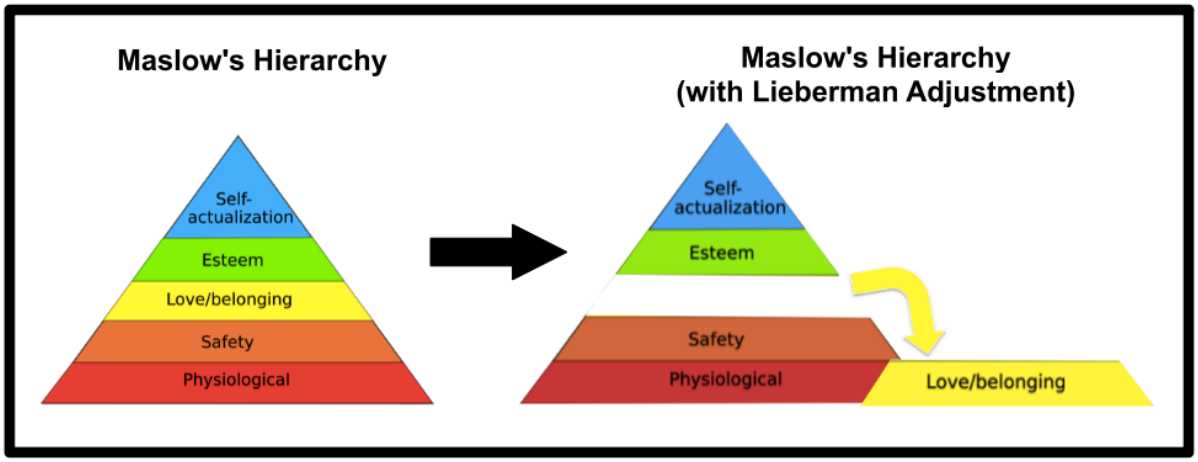

Figure 1. Maslow's Hierarchy with Lieberman Adjustment (Fierst, 2017).

nature of the brain and build educational systems that honor this truth. Lieberman argues our classrooms, our schools, and our students will not reach their full potential until we honor our social brains (Lieberman, 2013).

When students' social needs are met, it has many positive impacts on learning. Lieberman speaks to the benefits on the brain when students are socially included in the classroom. Social connection improves memory, GPA, thinking, and decision-making. Students can find similarities and differences between ideas more efficiently (Lieberman, 2013). Lieberman explains that dopamine is released in the brain when students socialize

while learning, leading to a heightened capacity in the prefrontal cortex, leading to better grades (2013).

Despite the many benefits of social inclusion, many teenagers struggle to find this connection in school. Students are often bullied, isolated, or ignored. There are real consequences to social exclusion in our schools. Lieberman explains that social pain in high school can lead to depression, anxiety, and decreases in attendance (2013). Lieberman connects social pain to physical pain. Both types of pain "activate the same neural circuitry" (2013, p. 4), which impairs cognitive function and memory—it also leads to decrements in intellectual performance such as decreases in test scores and/or GPA. In order to maximize our students' potential in and out of the classroom, Lieberman believes it is critical that educators shape "the context and the curriculum in light of what we are learning about the social brain" (2013, p.298). Moreover, if we understand and cater to our social nature, we can also improve our society.

Crisis of Connection

United States Society. McGregor reports, former United States Surgeon General, Dr. Vivek Murthey, believes loneliness is a growing health epidemic in the United States (2017). Murthey reports over forty-percent of adults feel lonely. This number is double the rate of over thirty years ago (McGregor, 2017). Sara Konrath's research analyzed empathy in college students. She found feelings of empathy have dropped since 1979, but the most dramatic drop happened after 2000 (Konrath, 2011). Konrath states that this is a relatively recent occurrence.

Niobe Way (2011), in her book *Deep Secrets,* agrees with Dr. Murthey and attributes increases in suicide rates of teenage males and drug use to the absence of close and deep

social connections. Way examines the conflict between gender norms bestowed on men and the limiting boundaries they enforce on their friendships and deep connections. Way's research addresses the profoundly negative impact of disengaging emotionally. Moreover, her work illuminates the strong positive relationship between increased pressure over time for men to socially disconnect and the increase in frequency of mass shootings committed exclusively by males in the United States (Way, 2011). She argues that males will continue to go "wacko" as long as their gender identity forces them to socially disconnect (Way, 2011, p. 267).

White Supremacy in Mathematics Education

Individualism. Equitable mathematics educators know there is no such thing as a "math person." They do not believe mathematics is an innate talent and believe that mathematicians can be developed and coached. But this requires grit and persistence. It means anyone who is willing to work hard can be good at mathematics. Carol Dweck (2006), the author of *Mindset*, is a leading researcher in persistence in learning. Mathematics educators across America have gravitated towards Dweck's research and have implemented her work into their classrooms. Dweck's *Growth Mindset* is based "on the belief that your basic qualities are things you can cultivate through your efforts" (2006, p. 7). Dweck describes a person with a growth mindset as someone who "embraces challenges, persists in the face of setbacks, sees effort as a path to mastery, and learns from criticism" (2006, p. 245). Dweck believes individuals with a growth mindset are more likely to learn and grow from their mistakes (2006).

In her book, *Mathematical Mindsets*, Jo Boaler (2016) more specifically connects Dweck's growth mindset to mathematical learning. Boaler believes that all students can

engage in high-level mathematics. Her work looks at how the brain grows and adjusts with experience. Each experience fires synapses in your brain. Repeated experiences generate multiple synapses forming new pathways in the brain (Boaler, 2016). Learning mathematics becomes easier overtime due to the plasticity of our brains. Boaler explains that students with growth mindsets increasingly achieve higher levels of growth in mathematics over time (2016). She also explains that struggle and mistakes are important. The brain grows most when it is being challenged. So even if you do not know you are making a mistake, your brain will grow if it engages in the challenge (Boaler, 2016).

There is a danger in growth mindset theory and its messages about learning mathematics. Dweck's mindset theory resembles the "Pull yourself up by your bootstrap" theory, the Myth of Meritocracy. She describes students who "avoid challenges, give up easily, sees effort as fruitless or worse, and ignore useful feedback" as having a fixed mindset (Dweck, 2006, p. 245). Dweck's work equips educators with labels for students based on a personal perception of student behavior. This is dangerous because meritocracy never existed and does not exist in our country. It is not as simple as "I can, why can't you?" Instead of growing students' brains, educators misuse this theory to identify the elite and reward students for their elite status.

Horace Mann claimed public education was the "great equalizer." However, today schools are more likely to reinforce disparities in socio-economic status. McNamee and Miller state, "Meritocracy requires equality of educational opportunity. The schooling system, however, provides the most privileged in society with greater opportunities to succeed and fewer chances to fail than it does for those form less privileged backgrounds" (McNamee and Miller, 2004, p. 102). They go onto explain how educational institutions are

designed to recognize students' upper-level status and reward it (McNamee and Miller, 2004). Educators implementing Dweck's theory and Boaler's work must be cautious of how they teach and implement growth mindset theory in their classroom.

McNamee and Miller explain how the Myth of Meritocracy ignores the impact of the system on the individual (2004). For example, meritocracy argues that the majority of educators are white because white educators worked harder. However, Oakley, Stowell, and Logan link lower percentages of Black educators to mandated desegregation efforts. Meritocracy ignores the historical impact of White Supremacy in America (Oakley, Stowell, and Logan, 2009). Boaler's and Dweck's work focuses on individuals and their willingness to persist and struggle. Consumers of the growth mindset ideology often only focus on the individual, their experience, practice, and belief in one's self. However, McNamee and Miller reveal the absence of a discussion about systems and power in their theories, creates inequities and bias in educators across America (2004).

Inequitable Access. Teachers send messages to students every day about their belonging in the *Mathematics Members Only* club. This is problematic because the majority of mathematics educators are white. The massive disparity between the number white educators and Black educators teaching mathematics has had a huge impact on equity in access for students. A sense of belonging has profound impacts on student achievement. Students of Color are constantly being sent messages that they do not belong in the mathematics classroom.

Teachers make more than 1,500 decisions every school day, that's more than four decisions every minute (Good and Brophy, 2008). Teachers make decisions very quickly and unconsciously. This allows for implicit bias to impact the decisions that teachers make. The

Implicit Association Test (IAT) measures the strength of the relationship between thoughts and stereotypes. The Race IAT was developed to establish perceptions about racial groups. Banaji and Greenwald discuss two conclusions developed from the Race IAT (2013). "White preference is pervasive in American Society. Second, the automatic white preference expressed on the Race IAT is now established as signaling discriminatory behavior" (Banaji and Greenwald, 2013, p. 47). This is dangerous because teachers identify as non-racist and democratic, however, a careful analysis of their behavior might suggest otherwise.

Banaji and Greenwald in their book, *Blindspot*, highlight evidence "of the dissociation between reflective egalitarianism and automatic preferences in attitudes involving race, sexual orientation, and age" (2013, p. 68). Research indicates these teachers do in fact demonstrate discriminatory attitudes toward People of Color (Banaji and Greenwald, 2013). Teachers make decisions about their students based on racist stereotypes. For example, a Student of Color's capacity to do mathematics well sometimes surprises white educators. However, white educators are not surprised that they are racist; instead they are surprised that this student is an exception to their racist imagination.

White Supremacy is sustained in mathematics education through elitism. Mathematics teachers are gatekeepers. They have an intense need to protect the academic integrity of the subject. Boaler believes the fixed mindset (mathematics as an innate ability) promotes inequities in access for Students of Color, women, and students from lower socio-economic statuses (2016). Mathematics course placements are based on individual abilities defined by educational systems and structures. She attributes inequitable access to the superiority complex of educators. Boaler acknowledges the systemic harm an educator with a fixed mindset can have on equity in mathematics education. She argues against the fixed

mindset in educators because is legitimizes the process of tracking students, thereby creating inequities in access. Moreover, she connects this "sorting mechanism" used by educators as a way to sustain societal advantages (Boaler, 2016). When educators foster and participate in elitism, they sustain societal advantages for some students, while simultaneously preventing other students from accessing high-level mathematics; they are agents of White Supremacy.

Mathematics is the only core subject in high school that is ability-based and not grade-based. Students are placed in grade level English classes, social studies classes, and science classes. Boaler cites course placement as form of inequitable access (2016). Access to mathematics education impacts access to advanced course work as early as the fifth grade. Sixth grade mathematics determines course entry into the ninth grade. What students take in ninth grade, determines what they will take their senior year (Boaler, 2016). Students, who do not take calculus by their senior, significantly decrease their readiness to embark in engineering courses. If you take your first calculus course in college, you still can be an engineer, but the competitiveness of the program makes your boots much bigger and your straps have become much less durable. It's not just about working hard, never giving up, believing in yourself, and getting after your dreams; there is a system in our mathematics classrooms and it promotes White Supremacy.

Dehumanization of Students. The learning of mathematics has become a dehumanizing experience for some of our students. Jesse Hagopian (2014), in his book *More than a Score*, discusses the many ways in which standardized testing intensifies inequities in our educational systems. Proponents of standardized testing argue the exact opposite. They claim standardized testing will ensure equitable learning for all students regardless of race, gender, class, or creed.

Hagopian refutes these claims and exposes the many ways in which standardized testing is harmful to every student except upper class white students. Hagopian names those benefiting from standardized testing, "testocrats." Testocrats include multibillion-dollar companies profiting from the sale of the exams and the "elite stratum of society that finances and promotes competition and privatization in public education" (2014, p. 9). He goes on to explain that testocrats are committed to dehumanizing education by reducing education into a score. The goal of the testocrats is simply to profit from education, not to ensure an equitable learning experience for all students (Hagopian, 2014).

There are many other issues with standardized testing that prevent equality within our schools. Schools that underperform on the exams, face many consequences and pressure schools into prepping students for the exam instead of engaging students in meaningful and rich learning experiences. In addition, many vital resources that supplement authentic and deep learning are reallocated for test preparation. This is an equity issue. The elite send their students to schools that do not engage in standardized testing (Hagopian, 2014). Moreover, the whiter and more affluent a school is, the less test preparation occurs during class and fewer resources are dedicated to preparing students for the exams. When affluent white students do better on exams it could then be inferred that because there is less test preparation in class and exam scores are better, affluent white students are inherently smarter. However, this belief ignores the economic divide between those who perform well and those who do not. The privileged can afford test preparation support outside of the school day. The privileged are then privy to more meaningful educational opportunities in school and test preparation support outside of the school day. Instead of creating more equity in our educational systems, standardized testing has created larger disparities in the types of

educational experiences Students of Color and poor students will have compared to their rich white peers.

Hagopian argues that standardized testing is rooted in the Myth of Meritocracy (2014). Society believes that students, who do well on these exams, do so because they work hard and because they are more intelligent. However, Hagopian states that test scores are " a better indicator of a student's zip code than a student's aptitude" because neighborhoods reflect the socioeconomic status of the student (2014, p. 15). Test scores measure students' access to resources.

Moreover, Hagopian discuss the origins of standardized testing. The SAT exam was introduced as a gate-keeping mechanism to gain acceptance into Princeton (2014). The writer of the exam, Carl Bringham, was a white supremacist who wrote an exam to honor the superior intelligence he believed white people to hold over others. Standardized exams are still given today and achieve the same results Brigham designed for in 1926.

Minnesota is no exception. Examining Minnesota's Comprehensive Assessment, it could be inferred that Minnesota educates white students very well and the state fails to educate Students of Color equitably. News outlets throughout the state report this educational disparity. An unintended consequence of reporting data of this nature is that it reinforces negative stereotypes about Black children's mathematics capabilities. The impacts of both stereotype threat and social disconnection profoundly impact Black students mathematics performance, not capacity.

Social connection can increase cognitive function and social isolation can have devastating impacts on learning. Steele and Aronson investigated the impact of stereotype threat and exam performance (1995). Steele and Aronson define stereotype threat as a

predicament in which a person potentially will behave or perform in a way that will reinforce a widely known negative stereotype about one's group. Their research examined the stereotype threat of African Americans and intellectual test performance (Steele and Aronson, 1995).

Participants were told the test was a measure of intellectual ability. Prior to taking the test, participants were given a questionnaire labeled "personal information." All questionnaires were identical except one (randomly assigned) group was asked to identify their race. The identification of race right before taking the test presented the "threat" (Steele and Aronson, 1995, p. 806). Steele and Aronson go on to explain that participants do not have to believe the stereotype to be true about them, only that they may be characterized by the stereotype in that particular moment. Their testing experience is now burdened by this threat—which is not faced by people not characterized by the negative stereotype (Steele and Aronson, 1995).

In the group that did not identify their race, Black students outperformed the white students. However, when Black students were asked to identify their race, and faced by stereotype threat, they performed significantly worse than the Black students who did not indicate their race. White students, who reported their race prior to taking the exam, outperformed the white students who did not indicate their race. The threat impaired Black participants' performance and white participants abilities were heightened through their identify and intellectual performance (Steele and Aronson, 1995).

Restructure

Critical Race Theory. Critical Race Theory (CRT) provides both educators and students a language to discuss and understand power, privilege and race. People have an idea

of how they respond to racism and then there is the reality of how they actually respond to racism. CRT allows educators and students to explore this disconnection. Furthermore, white educators must explore and discuss the construct of whiteness: What is it? How and when do they become aware of their whiteness? Teachers must challenge their own and their students' well-established ways of thinking that frequently limit their own potential. It is critical for students to access language to discuss this at a young age when they are still deciding how to make their imprint in this world.

In his book, *Between the World and Me,* Ta-Nehisi Coates (2015) discusses race as a social construct. Coates indicates that race is a modern invention that was created to institute hierarchy (2015). The hierarchy is designed and succeeds at elevating the white race and destructing Black bodies. Coates explains, "The power of domination and exclusion is central to the belief in being white, and without it, 'white people' would cease to exist for want of reasons" (2015, p. 42). Coates explains why the American Dream is rooted in the Myth of Meritocracy. In order for White Supremacy to exist subliminally in the minds of its constituents, its members must not only believe in the myth but for it to be fair (Coates, 2015). White people choose to believe their superiority over others because they worked hard and "others" did not.

Coates explains, "people who believe themselves to be white are obsessed with the politics of personal exoneration" (2015). Coates clarifies that white people do not build a capacity to ignore evidence of their racism overnight. White people develop their racist imaginations over time and this "plunder has matured into habit and addiction; the people who could author the mechanized death of our ghettos, the mass rape of private prisons, then engineer their own forgetting" (Coates, 2015, p. 150). The evidence of White Supremacy in

our educational systems is present, however, it is the instantaneous forgetting, and that sustains the oppression of students, families, and Communities of Color in our country.

The destruction of the Black body is just as vital to White Supremacy as the elevation of the white race. Coates documents White Supremacy's visceral need to destruct the Black body to preserve power and domination (Coates, 2015). Evidence of this destruction rests in the distinction made between "Black life" versus "Black bodies" in America (Coates, 2015). The authority given to police to kill Black men, White America's removal of Black beauty, and the violence in the streets all define Black life as cheap (Coates, 2015). However, Coates goes on to explain, "but in America Black bodies are a natural resource of incomparable value" (2015, p. 132). The existence of the American Dream is built upon the backs of Black people in America. Moreover, "the Dreamers accept this as a cost of doing business; accept our bodies as currency, because it is their tradition." (Coates, 2015, p. 131).

Coates finds schools to be problematic in that they do not reveal historical truths in regards to power, privilege, and race in America; instead schools try to conceal them (2015). Coates describes the complexity young people face understanding structures that sustain White Supremacy. He believes they struggle to understand because "they attach it to specific events" (Coates, 2015, p. 21). Coates further explains, "The dream thrives on generalizations, on limiting the number of possible questions, on privileging immediate answers" (2015, p. 50). Coates description of the dream mirrors the realities of mathematics classrooms across America. White Supremacy shows up as elitism in mathematics classrooms across America, honoring quick answers and deciding which questions deserve a response.

Coates does provide insight on the point of education. Our current system dehumanizes students; however, Coates believes education should be used to find one's

humanity “in all of its terribleness” (2015, p. 52). He also believes that education should be used to uncover systems and structures that sustain White Supremacy. Most importantly, he believes questions and questioning are the heart of education because “questions matter as much, perhaps more than, the answers.” (Coates, 2015, p. 116). Educators must remind themselves of the point of education at all times. The system works hard to distract and engineer the forgetting of this work. Coates knows “The Dream is the enemy of all art, courageous thinking, and honest writing” (2015, p. 50). To disrupt and dismantle White Supremacy, educators must be brave and become artists in their classroom. They must engage in courageous thinking to move past the obstacles and systems that prevent them from seeing their students as beautiful humans who have the capacity to thinking deeply about their world and develop them into agents of change.

Culturally Relevant Teaching. The political events over the last year highlight the profound disconnection from others. Niobe Way argues that it is this disconnection that causes chaos (2011). Moreover, we live in a culture that is premised on disconnection (individual over community). But, Way agrees with Lieberman in that our survival is dependent on this connection. She questions, “How do we foster political resistance to this disconnection?” “How do we become more human?” Culturally relevant teaching (CuRT) honors relationships and student voice. Every single student should feel they belong in and to our schools.

It is clear who does not belong when we look at our Minnesota Comprehensive Assessment (MCA) scores. The poorest white students outscore the wealthiest Black students. This is particularly important when we acknowledge the deep contrast between our educators and students. Ninety percent of the educators in Minneapolis are white and over

sixty percent of our students are Students of Color. Belonging must be intentional. Educators must intentionally build relationships with students and honor those relationships in the classroom. The mathematics classroom must be a place that embraces our social connections and values the collective over the individual.

In her book*, Culturally Responsive Teaching*, Geneva Gay (2010) discusses the potential and the power of implementing CuRT practices. Just as important, she describes the praxis of this theory. While Gay acknowledges that CuRT alone will not eradicate White Supremacy in education, she does believe this work can reverse some of the negative impacts the system has on the achievement of Students of Color (2010). Gay defines CuRT as "using the cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students to make learning encounters more relevant to and effective for them" (2010, p. 31). CuRT does not view students as empty containers that need to be filled up by the educator, the grand provider of all knowledge. Instead CuRT believes every student brings something to the learning space and builds on the strengths of each student (Gay, 2010).

CuRT rejects the white supremist deficient view of students; instead cultural differences are recognized as assets. Gay shows how classrooms are designed and instructional practices are implemented to value all students and cultures in the classroom. CuRT confronts racism, intolerance, injustice and oppressive structures in the classroom and transforms them to create balance and equality for all students (Gay, 2010). Gay also describes CuRT as a medium to support students in their agency.

CuRT engages all educational platforms. Gay indicates CuRT, "encompasses curriculum content, learning context, classroom climate, student-teacher relationships,

instructional techniques, classroom management, and performance assessment" (2010, p. 33). She goes on to explain CuRT can be transformative if expectations for all students are high and "academic success and cultural consciousness are developed simultaneously" (Gay, 2010, p. 36). Successful and transformative CuRT incorporates community, social awareness, student-teacher relationships, and student-student relationships (Gay, 2010).

Gloria Ladson-Billings' is an advocate of culturally responsive teaching as well. In her book, *The Dream Keepers*, Ladson-Billings describes three features of a culturally responsive school (2009). She explains that parents and teachers are stakeholders in their students' education and should tell the schools what they want and expect and the school should provide those things (Ladson-Billings, 2009). This is not an uncommon practice for middle and upper class white schools. However, schools attended by Students of Color are designed in ways that are not meaningful for the students in attendance. Furthermore, school districts become less flexible when charged with the task of responding to parents and teachers.

Ladson-Billings states that schools must honor and respect the students' home culture (2009). She is not arguing for a complete overhaul of the curriculum to erase and replace all of white culture. She advocates for an honest and accurate representation of non-dominant cultures. The more educators learn about their students, the more they will recognize and value their assets in class.

Thirdly, Ladson-Billings believes schools must partake in helping students understand the world as it is and equip them to change it for the better (2009). Ladson-Billings explains African American children need help "with knowledge, skills, and attitude needed to struggle successfully against oppression" (2009, p. 153). All students need help in

their struggle against oppression, and this includes white students and their role as oppressors.

Praxis vs. Theory. A culturally relevant pedagogy combined with Critical Race Theory should present the solution to the inequitable learning experiences that persists in mathematics education across the country. However, there are several studies that discuss and demonstrate the difficulty of putting this theory into practice. Leonard, Napp, and Adeleke address the complexities of incorporating CuRT in secondary mathematics classrooms (2009). This study discusses the lack of appropriate examples of a successfully implemented design in a secondary mathematics classroom. Moreover, Leonard, Napp, and Adeleke found that CuRT is difficult to successfully implement in mathematics classrooms (2009). One of the biggest issues in successfully implementing CuRT in the mathematics classroom is the complex nature of acknowledging the needs of the teacher prior to implementation and the teacher's role in the mathematics classroom. Often times these two things contradict one another.

Esposito and Swain found that a CuRT could be implemented into a mathematics classroom when it is tied to issue of social justice (2009). Esposito and Swain believe that issues of social justice naturally arise when a CuRT is implemented in a mathematics classroom (2009). Tutak, Bondy, and Adams research suggest that "critical reflection can lead to critical consciousness, which enable people to understand their lives in new ways and consider ways to change systems that routinely oppress particular groups" (2009, pg. 66). Tutak, Bondy, and Adams also argue that there is not enough resources or examples of successfully implemented CuRT in mathematics. Mathematics teachers need to be able to tie state curriculum to discuss how numbers are used to dominate and liberate.

We know that the white supremist routine of mathematics education is not successful for all of our students, in particular, our Native, Black, and Hispanic students. The context of mathematics education needs to change so that it includes, values, and supports Native, Black, and Hispanic students in the same way that it supports white students. This can happen when a culturally relevant pedagogy is combined with a critical pedagogy to explore issues of social justice that are meaningful for students. We know that not many resources or examples exist for mathematics educators to adapt, which leads to challenges for educators trying to teach more equitably.

Boaler offer strategies to provide more equitable access in mathematics. Schools need to offer all students high-level content. Educators need to shift their views on who can achieve in mathematics, teachers must have growth mindset beliefs for all their students. It is also critical to engage all students in thinking deeply about mathematics (Boaler, 2016). Boaler believes this can happen when educators use hands-on experiences, project-based curriculum, curriculum with real-life applications and opportunities to work together (2016). Boaler also tasks educators with teaching their students how to work together. She regards group work as "critical to good mathematics work" and deems group work necessary in "countering racial inequities in mathematics achievement and course taking" (Boaler, 2016, p.104).

Conclusion

Despite the social nature and needs of our brain, mathematics education in America values the individual. Valuing the individual is a key factor in sustaining White Supremacy in mathematics education. Elitism preserves sorting mechanisms that are in place that favor white affluent students. These sorting mechanisms include: placement exams, tracking tools,

high-stakes assessments, educator's fixed mindsets tied to student capacity, educator's implicit biases, and the over-representation of white mathematics educators in the classroom.

These mechanisms communicate to students their belonging in the classroom or lack thereof. Those accepted into the *Mathematics Members Only Club*, will do better because they are valued and feel a sense of belonging. These students' values and social connections will constantly be reinforced. However, the remaining students will know they do not belong and will struggle to perform at their highest capacity due to the impacts of social exclusion. Mathematics education embraces White Supremacy and needs to be dismantled.

CRT can be combined with CuRT to expose and transform oppressive structures in mathematics education. CRT provides language to analyze and uncover patterns used to support oppressive systems. On a micro-level, these systems prove to be incredibly difficult to address. CRT honors students' humanity and utilizes it to reveal White Supremacy in classrooms, schools, and communities.

Moreover, CuRT practices connect that application of mathematics to CRT. CuRT requires teachers to build relationships and social connections in their classrooms. CuRT values student voice and provides students with opportunities to see themselves in the curriculum. CuRT ensures educators believe that all their students are capable, beautiful, and essential to the growth of every individual in the classroom. CRT and CuRT refute the Myth of Meritocracy on a systems level and an individual level.

The responsibilities placed on public school educators are immense. Additionally, the realities families, teachers, and students face today are complex and require more resources. Therefore, despite the overwhelming amount of research that supports CRT and CuRT in the mathematics classroom, the practicality of implementation is minimal. *How can mathematics*

education be restructured to dismantle White Supremacy in the mathematics classroom, improve content mastery, and increase student agency?

Chapter three will provide a curriculum framework that will incorporate Critical Race Theory, culturally relevant teaching practices, and the social brain in secondary mathematics classrooms to disrupt white supremist structures in mathematics education, namely: inequitable access, the dehumanization of the student, and individualism (See Figure 2). Even though today's educators did not build the stool on the left, they are either sitting on it and are agents for White Supremacy or they are dismantling the stool and build a new one that promotes equity and justice for all.

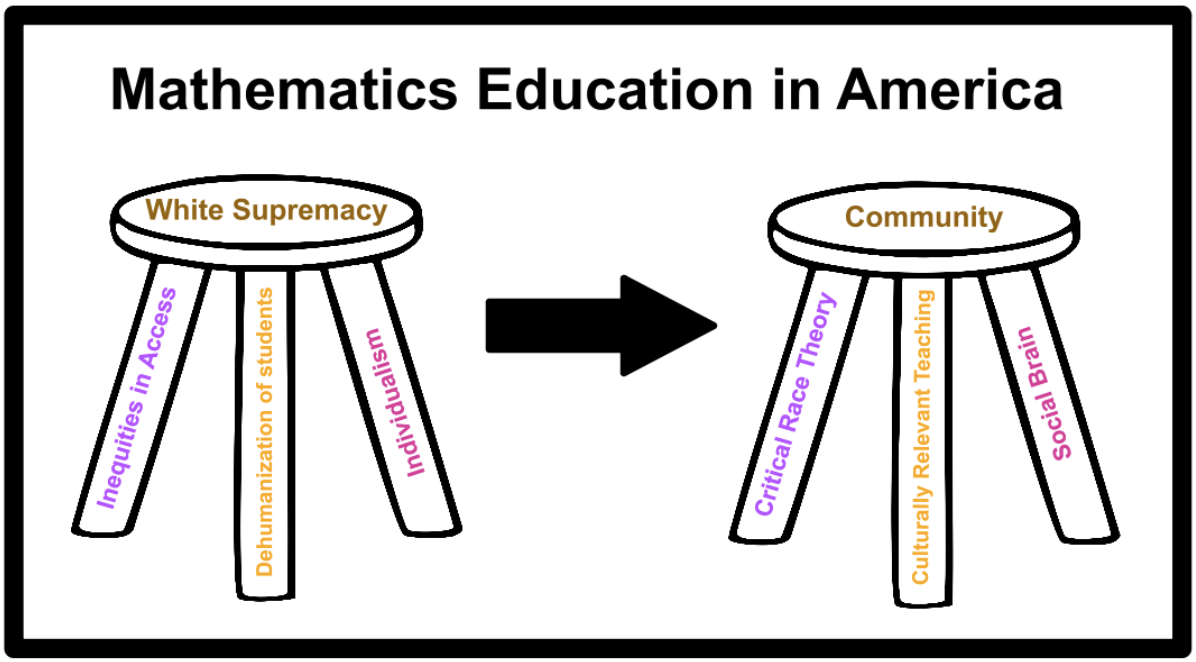

Figure 2. Mathematics Education (Fierst, 2017).

CHAPTER THREE

Project Description

Introduction

Three main structural issues in mathematics education need to be addressed: inequitable access, the dehumanization of students, and the emphasis of the individual. These three structures support the structure of White Supremacy in the mathematics classroom and will continue to do so until mathematics education in America is interrupted and transformed. There are many systems and structures that create inequities in access to mathematics education. Chapter two examined systems that routinely oppress particular groups of students. The purpose of this chapter is to provide a framework for high school mathematics teachers in developing a curriculum that will interrupt White Supremacy in the mathematics classroom. This framework can be used across content areas and should not be limited to mathematics courses. The curriculum responds to my research question: *How can mathematics education be restructured to dismantle White Supremacy in the mathematics classroom, improve content mastery, and increase student agency?*

Overview of the Project

Culturally relevant curriculum and Critical Race Theory are absent in an overwhelming majority of high school mathematics courses. In Chapter two, research clearly indicates the need for educators to engage in Critical Race Theory that implements a culturally relevant curriculum. Despite good intentions and a desire to engage with this type of curriculum, mathematics educators lack resources and know-how for successful implementation. This project aims to be a curriculum that is culturally relevant, practical, and uncovers systems of power, privilege, and race.

This chapter outlines a yearlong advanced algebra curriculum that is rooted in student voice and community engagement. The project includes essential foundational work, curriculum design, a pacing guide, course-learning targets, Minnesota state mathematics standards, and a five-step framework. The framework engages educators in designing a set of yearlong unit challenges that are based in student voice, current community issues, and content specific learning targets. This five-step framework also discusses how Critical Race Theory and culturally relevant teaching practices are integrated to expose oppressive systems. The impact of the curriculum will be evaluated through an end-of-the-year student capstone project.

Rational

"When are we ever going to use this?" is a question students often ask when they do not see the connection or relevance from the instruction to the real-world. In addition, students' social connections are basic needs that must be met before learning can take place. This project sought to address students' need to know (relevance), content, and even more importantly how they see themselves in it.

Our survival is dependent on social connections; our society is not. Way implores us to foster a political resistance to this disconnection. Lieberman's work urges educators to shape their curriculum and the context in which they teach it to engage the social brain. Coates reminds us to use education to find our humanity; to use questions to uncover structures and systems of White Supremacy. Mathematics is an important venue to foster a political resistance to disconnection and White Supremacy.

My project incorporates culturally relevant teaching (CuRT), Critical Race Theory (CRT), and the social brain to build and analyze our community as a means to find the

humanity of our students, develop our students' agency, and interrupt the unbalanced and inequitable power structure in the mathematics classroom.

White Supremacy has built strong and powerful systems in mathematics education. Boaler advocates for educators to engage in equitable strategies that interrupt oppressive systems in the schools (2016). Educators can implement equitable learning experiences by engaging students in hands-on activities, project-based curriculum, real-life application, and opportunities to work together (Boaler, 2016). Moreover, Coates proposes that education can uncover structures and systems through questioning (2015). He states "questions are the heart of education, because questions matter as much, perhaps more than, the answers" (Coates, 2015, p. 116). Gay and Ladson-Billings recommend implementing a CuRT to humanize students, build relationships, and to honor student voice. They believe students deserve access to an equitable and accurate representation in their curriculum. Gay and Ladson-Billings also believe students need to develop their agency to change the world for the better.

My project aims to incorporate questions, real-life application of mathematics, project-based curriculum, and opportunities to work together. Moreover, the project develops a framework that honors student voice and their prior experiences to build authentic community-based investigations that develop student agency. Students come to rely on one another to uncover structure and systems of White Supremacy in the classroom and in their community while simultaneously building content mastery. This project combines the work of Coates, Gay, Ladson-Billings, Way, and Lieberman to provide a response to my question: *How can mathematics education be restructured to dismantle White Supremacy in the mathematics classroom, improve content mastery, and increase student agency?*

The Foundation

The development of this curriculum acknowledges many external pressures public high school educators face. Educators often find it difficult to change systems because they are overwhelmed with district mandates, content pacing directives, high-stakes assessments, coverage of state standards, and more. Many educators find themselves in survival mode and unable to be transformative in their work.

Successful implementation of the project requires a detailed review of course content and pacing. Prior to the beginning of the year, educators must identify the scope and sequence of their course. Educators must eliminate any superfluous and redundant content. Course learning targets must be written in a student-friendly language, cover all state standards designated for their course, and cover all necessary prerequisites content for subsequent upper level mathematics courses (See Appendix A).

It is important to be intentional about what will be taught in the course and how much time is necessary to cover each topic. Unit challenges range from one to five days each and require a thoughtful analysis of pacing and content coverage. Once course content is defined, educators must establish a pacing guide that will cover all of the content and incorporate as many unit challenges as possible (See Appendix B). A yearlong pacing guide will help educators strategize on how to incorporate unit challenges throughout the year.

In addition to setting up the logistics of the course, educators must be intentional about how they will construct the social-emotional learning atmosphere of the classroom in the beginning of the year. As research indicates, a few things must be in place to make the work as effective and meaningful as possible. It is essential that educators intentionally create a safe classroom by building relationships *with* the students and *between* the students. If

students do not feel safe to discuss tough issues in the classroom, they will not fully participate in unit challenges.

The first two weeks of the school year should be used to intentionally build community. Many educators are concerned about delaying the start of curriculum, but building a safe classroom allows educators to move through the curriculum faster than their colleagues. This is important for social justice investigations but also the development of students who will challenge themselves with content.

For example, Name Tent Feedback forms built relationships immediately (See Appendix C). They were used the first five days of the school year. On the outside they were blank and used as a name tent. Students wrote the name they preferred to be called in class. On the inside, students wrote comments, questions, concerns, etc. to the teacher, who would then respond each day. The daily communication between student and teacher built connections immediately and authentically.

Another powerful tool in building relationships within the classroom was providing students with a list of names; an edited roster that reflects preferred names, along with a blank seating chart (See Appendix D). Each day, a group of five students were introduced. All students documented the preferred and phonetic spelling of their classmates' names on their seating charts. The next day, students assessed their own knowledge of their classmates' names, and the cycle continued until all students were introduced. Once all students were introduced, names were reviewed for a few days, and a name assessment was conducted.

Social connections improve cognitive function and should be intentionally built every single class. Relationship building and name fluency should not end after the first couple weeks of school. Every time new seating charts are introduced, an additional introduction

activity should be implemented. In addition, group work routines and expectations can be built to promote healthy relationships throughout the year.

The Framework

Once a pacing guide, course-learning targets, and a safe classroom environment have been developed it is time to engage students in a culturally relevant curriculum in the mathematics classroom rooted in Critical Race Theory. Educators should use this framework along with students' voices to develop unique unit challenges that are relevant to their interests and community. At the beginning of the unit, the teacher presents an essential question that will be explored throughout the unit. Educators will develop and design a unit challenge that responds to students' interests and applies mathematical content that requires further attention. Students will complete unit challenges at the end of a unit but prior to the unit exam. Below is a description of the framework:

Step 1: Generate questions. Design unit challenges to respond to student questions. In each unit of study, present students with an essential question about a specific social issue present in their community. Questions should be open-ended and general. For example, the initial question asked in Unit 1 was "To what extent is racism a factor in mortgage lending? How does access to fair and equitable lending practices impact my community?" (See Appendix E).

Students work in their groups to generate as many questions as they need in order to answer the essential question. Students should not try to answer the question at this point. They should think about all the things they would need to know in order to respond to the unit question. This is an opportunity to assess students' social and mathematical prior knowledge. These questions will eventually guide the design of the unit challenge. Students

asked many questions. Examples include: “What is mortgage lending?” “Is it like this in my neighborhood?” “Who decides who gets loans?” “How does credit scores play a role in this?” “How do loans work?” “Does the area of a house affect who gets to live there?” “Does the price of the home matter?” (See Appendix F).

Step 2: Build & Master Unit Concept & Skills. Learning targets for the unit will guide daily lessons that encourage student mastery of mathematics concepts and skills. During this time, use tasks to address student questions developed from *Step 1*. Analyze current articles and/or news stories in class. Include materials to help build connections and curiosity between the mathematics and social topics focused on in that unit.

For example, students at South High School in Minneapolis read several articles about mortgage companies that were sued or settled outside of court for discriminatory lending practices and redlining. In addition, students examined a report, *Communities in Crisis*, from the Institute for Race and Poverty, which examined race and lending practices in Minneapolis (2009).

Step 3: Unit Challenges. At the conclusion of the unit, apply mathematics concepts and skills to develop a better understanding of an issue present in the community. Design the challenge using student interest, as collected from the unit’s essential question, and develop it to involve mathematical content that students struggled with conceptually, as observed during formative assessments. Unit challenges must be relevant and use current data and information, and they must not result in a specific right or wrong answer. Rather, design the challenge so each student arrives at and justifies their conclusion through the mathematics generated in the unit challenge.

For example, many students struggle to master calculator proficiency with recursive sequences because they did not have the technology at home. In addition, students struggled to write recursive sequences that involved annual compound interest. The unit challenge was designed to explore the structure of mortgage loans and provided a group task that required all group members to work together in writing recursive sequences to model mortgage loans (See Appendix G). Students were presented with an actual home that was for sale at the then current median home price in Minneapolis. Students were tasked with determining the monthly payment required to pay off a mortgage loan in exactly 30 years. This work required students to use their calculators and to write recursive routines that modeled annual compound interest. In addition, students had to report the total price paid for the home and more. Students were unaware that each group had been given a different annual interest rate. The *Communities in Crisis* report indicated that many Black applicants were given a higher interest rate than for which they qualified (2009). Groups shared results on the impact that a difference in one or two percentage points could have on a monthly payment and on the total amount paid for a home (Appendix H).

Step 4: Reflections. It is essential to create time for students to reflect. This is one of the most important parts of the entire process. Reflections should be open for approval and criticism of the work. In addition, they should be group- and individual-based. In the Unit 1 Challenge, groups had to decide if lending practices were racist in Minneapolis and justify their response on their solution page. In addition, each student had to submit their own reflection on the work. In the individual journal, students spoke to the strengths and weaknesses of the challenge.

Specifically, students appreciated the connection between the course content and their community. Many students wrote about the impact of a one-percent increase in interest can have on a mortgage loan (short and long term). Students overwhelmingly appreciated the knowledge to build a deeper understanding about loans. Many students communicated that this was the first time they had discussed loans and financial health. Students reported that they still had a lot of unanswered questions and wanted to know more about why subprime lenders were able to operate and take advantage of Communities of Color. Students wished there was more closure in terms of what happened to the banks and to North Minneapolis.

Step 5: Repeat. This process will repeat for as many units as time permits throughout the school year. Each unit will build on the previous unit (See Figure 3). Not every unit will include a unit challenge due to pacing and content limitations. That is okay as long as students participate in several unit challenges throughout the year. It is important to make the process of challenging social constructs transparent to the students.

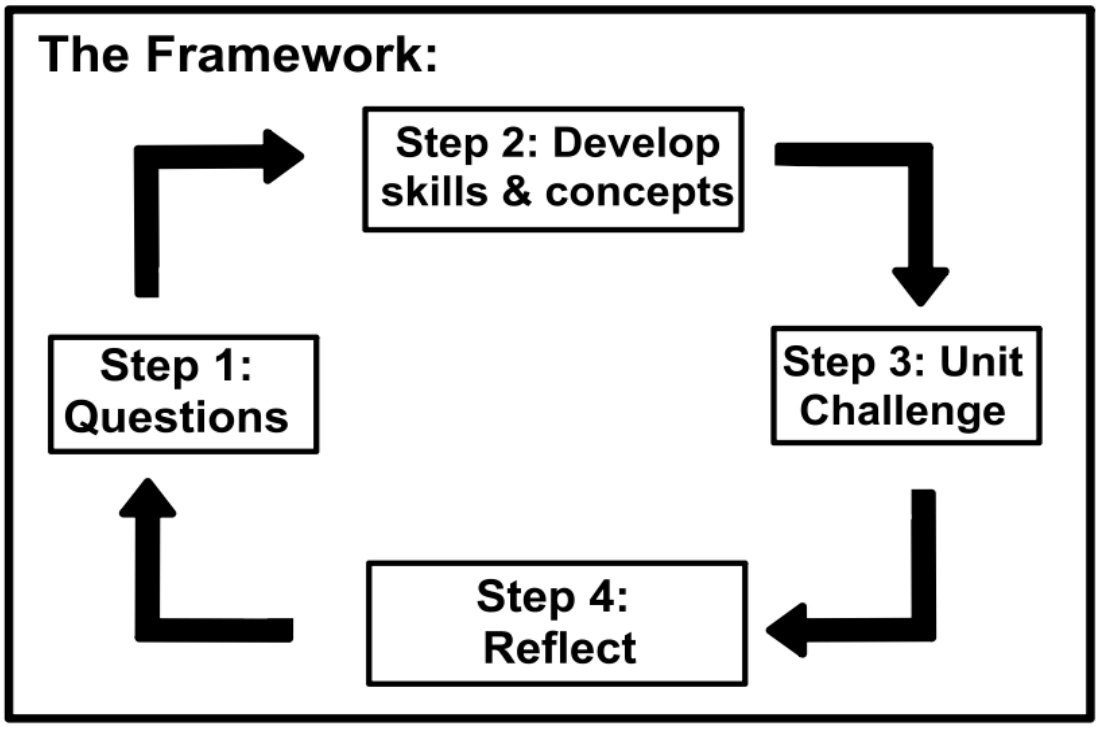

Figure 3. The Framework Cycle (Fierst, 2017).

After looking at discriminatory lending practices in Minneapolis, students were confused as to how lenders were allowed to engage in racist decision-making, especially when race had not been recorded field on the loan application. One student suggested that lenders did not need applicants to indicate race on the application because Minneapolis is segregated. The student went on to say, as long as lenders knew the location of the home, the applicant's race could be inferred. Therefore, the next unit challenge asked students, "To what extent is Minneapolis segregated?" (See Figure 4).

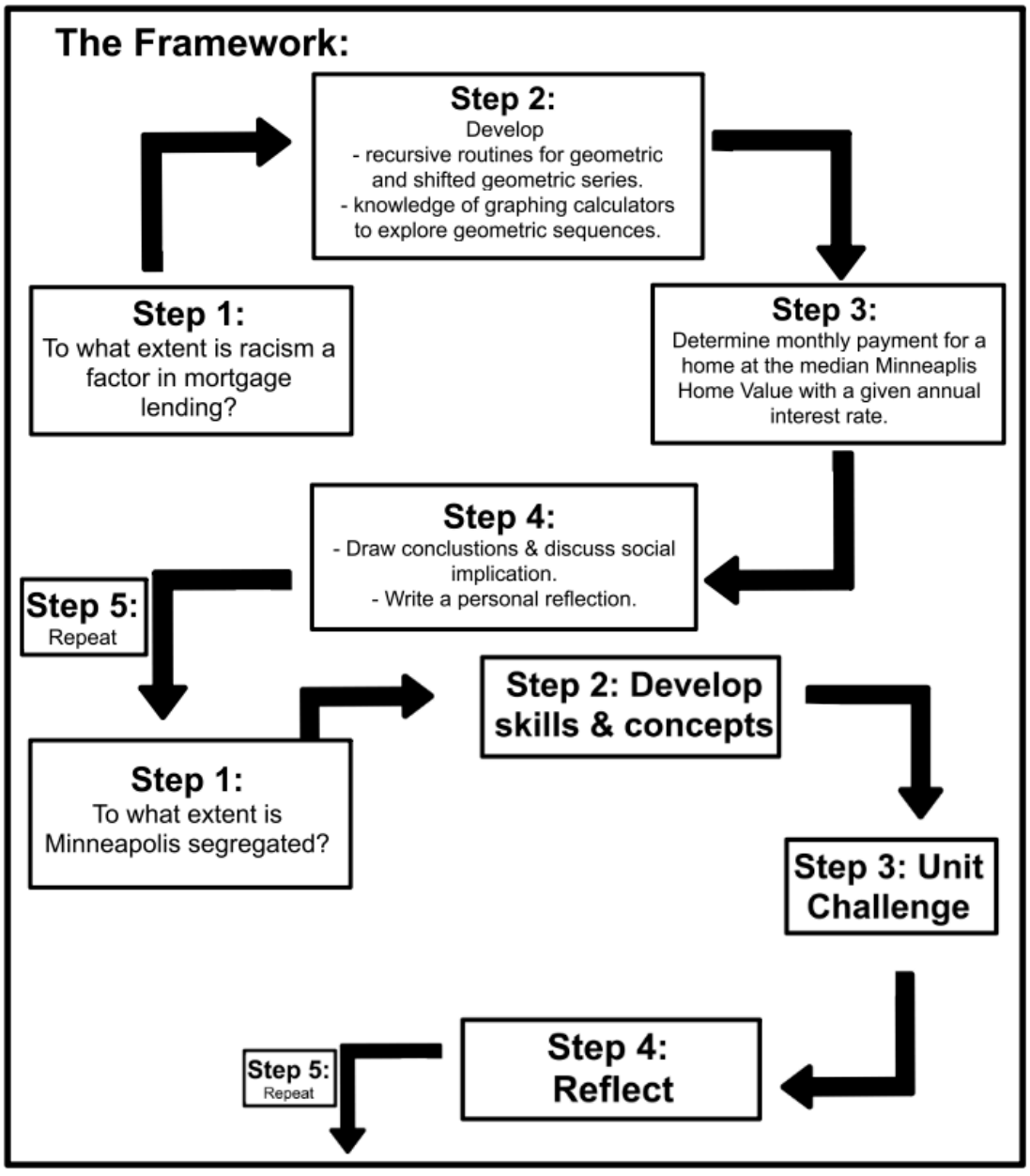

Figure 4. Example of Framework Cycle (Fierst, 2017)

Assessment

In the final quarter of the year, students create their own unit challenge, a critical learning project (See Appendix I). Throughout the project students work in groups to identify and explore an issue they are passionate about. Educators should provide each group with a set of course-long learning targets. Students will use the collection of learning targets to reflect on the mathematical arsenal available to them. It also helps students to name and label the mathematics used. Students determine which mathematics will best develop a deeper understanding about the impact of the issue within the community. Their critical learning project is a product, driven by course-level mathematics that expresses a deeper understanding of an injustice to an audience of community members and stakeholders.

For example, advanced algebra students created short public service announcements. The videos sought to bring awareness to an issue the students cared about deeply—their message driven by course-level mathematics. Students investigated fair and equitable public school funding options, access to affordable post secondary education, voter ID amendments, standardized testing, the school-to-prison-pipeline, race disparities in unemployment, and more. Videos were then presented at a student exhibition night in which over 300 people attended (See Appendix J).

The learning process will emphasize students' capacity to think critically and about how they can use mathematics to better understand their world. Contrary to unit challenges, where students worked with a specific set of mathematics and social context was connected to the mathematics, critical learning projects challenge students to take a context and determine how mathematics could be applied to it. This is a critical step in building mathematical fluency with students.

Conclusion

As educators, we are charged with developing learners. We need to facilitate the development of big and critical thinkers. We want to support the creation of socially conscious citizens who will generate and work for change. I propose that in order to achieve these lofty goals we must first provide students the opportunity to develop critical skills for recognizing and analyzing social inequities. We must have the courage to talk about race, power, and privilege in all of our courses. We must be creative in finding ways to bring cultural relevancy, Critical Race Theory, and real-world meaning to our content. Being a good mathematics teacher cannot be about the mere instruction of mathematic skills anymore. Being a mathematics teacher must evolve into providing students the opportunity to utilize mathematics in ways that are meaningful to themselves and their community. We must empower students to embrace mathematics as a means through which they can question and explain, create and convince. They must have the chance to see how mathematics can work to inform their life's decisions so that the students, in turn, may someday work to institute change.

CHAPTER FOUR

Project Description

Introduction

Public school educators are overwhelmed and under-supported. There is not enough time or energy to successfully perform the multitude of duties and challenges educators are tasked with every day of the school year. Public school educators are in survival mode. Most teachers have learned to eat their entire lunch in under five minutes or how to ignore their mid-day hunger all together. Teacher's bladders have become limitless and only speak up at the end of the day after all students have left the classroom. Once the school year commences, family members and friends are once again greeted with the all too familiar "Do Not Disturb" door hanger. Despite working sixty to seventy hours per week, public school educators still find themselves struggling to complete their to-do list. They want to address, transform, and improve their curriculum and learning space, but are exhausted and struggle to conjure up the energy required.

Tired or not, every decision educators make either sustains or interrupts White Supremacy. Educators must provide all students with an equitable education. In particular, mathematics teachers must address three main structural issues in mathematics education: inequitable access, the dehumanization of students, and the emphasis on individual performance. These three structures support White Supremacy in the mathematics classroom and will continue to do so until mathematics education in America is dismantled and resturctured. The purpose of my project was to answer the following questions by providing a framework for high school mathematics teachers: *How can mathematics education be*

restructured to dismantle White Supremacy in the mathematics classroom, improve content mastery, and increase student agency?

Reflections

The implementation of my framework went much smoother than I had anticipated. This project had a strong and positive impact on the culture of learning in my classroom. Student attendance increased significantly, students were excited to come to class. Student engagement increased as they completed more chapter challenges. I no longer had to manage student behavior and went from writing an average of eight behavior referrals a month to zero. Students no longer asked "Why are we learning this?" or "When will I ever use this in real life?" They knew the mathematics they were learning was relevant and meaningful to their understanding of the world. Students' confidence and trust also strengthened over the course of the year. Students opened up and engaged deeper in class discussions and during personal reflections. They leaned on and saw each other as essential to the work they created together. Students felt empowered to develop their own opinions and conclusions about social issues present in our community.

My administrators, parents, families, and students were supportive and affirmed the implementation of Critical Race Theory in the mathematics classroom. I worked hard and was proud of my courage, dedication, and follow through. Shortly after implementing the framework, I was nominated for the Presidential Award for Excellence in Mathematics and Science Teaching (PAEMST). This is the highest recognition a mathematics teacher can receive in the United States. The following September, I was on a flight to Washington, D.C. to receive my award from the President of the United States. I reflected on the meaning of this award and saw the award as an acknowledgement of the sacrifices educators make in our

relentless pursuit of providing a high quality education for all of our students. I was proud of myself. Not long after, I realized this award once again exposed my privilege and whiteness.

My work was impactful and powerful because I was able to question and challenge the teaching of mathematics at my school. The ease in which I was able to implement this project is not, and will not, be the same experience that Teachers of Color will experience in their schools. They will not automatically be applauded and recognized for their work. They will be questioned, the rigor of their content will be criticized, and their work will be seen as strictly that, their work. Their white colleagues will not see this as special or out of the ordinary. Moreover, on the off chance that they do get recognized for their work, many white people will attribute this achievement to the need of the award to appear inclusive, and not based on the merit of their work alone.

Every decision I make everyday will either sustain White Supremacy or interrupt it. I have an obligation to make my unconscious, conscious. The instantaneous forgetting must become instantaneous recognition of White Supremacy because when we know better we do better.

Benefit to the Profession

My first year of teaching was frustrating and disillusioning. The only reason I got into teaching was to level the playing field for all students, to address inequities in educational experiences. However, I was creating and sustaining the inequities I was vehemently opposed to. I felt handcuffed and ill-equipped to pursue my intentions. This project provided insight on how to implement “best practice” into real practice. I did not give up easily and pursued research, experts, and examples to adjust and adapt my strategies. However, mathematics

educators avoid and resist culturally relevant teaching practices and Critical Race Theory in general, so resources and support for engaging in this work were sparse and non-existent.

Social Connection. Chapter two examined the social nature of the brain. Lieberman implores educators to engage the social brain in their classrooms (2013). Lieberman places love and belonging at the base of Maslow's hierarchy—something essential to survival, a basic need that must be met before students can learn (2013). He urges educators to "shape the context and the curriculum in light of what we are learning about the social brain" (2013, p. 298). Challenges were designed so that every student, in every section, was critical to the success of the project. I deliberately designed challenges that included every student, and their participation was critical to the success of the project. For example, Minneapolis—which is divided into eleven communities, with each community then broken down into neighborhoods—totals eighty-three neighborhoods. Students had to analyze those eighty-three neighborhoods in order to fully understand Minneapolis. This required the efforts every student in all sections of my advanced algebra course. Every student was essential to the work—their presence and absences were felt and noticed; they belonged.

Collegial Interactions. This project presented me with opportunities to take risks and make mistakes, to rely and call on the support of colleagues, university professors, and community members when I had questions or was stuck. Just as educators run to their students' side with their hearts and hands wide open, so were my calls for help. I reached out for help and everyone I contacted did everything they could to support my work. If they did not have the answers or resources I requested, they called on their colleagues and contacts. It was amazing how quickly a network of support was built. This network contributed to my capacity to provide real and accurate data to explore meaningful questions in class. This

support system did not just reach me, it positively impacted my classroom as well. The students knew that other people were out there—strangers—who genuinely wanted them to succeed and have a meaningful learning experience.

Engaging Students Differently. In the typical power structure in a high school mathematics classroom the teacher holds all of the knowledge and bestows their knowledge upon the students. This illuminates educators' deficit view of their students. This is harmful and destructive. The power structure shifted and transformed in my classroom because students were responsible for constructing knowledge. Students drew conclusions about social issues based on the mathematics they generated in challenges. They also created products that informed other students and their community about their findings.

Using real data gave power to conversations we had about our communities. For the first time in my teaching career, the students and I were engaged in authentic mathematics. Answer keys were not made ahead of time, and I often did not know what the mathematics would reveal until the students completed and shared their findings. We built a community of trust and respect. I valued the students and appreciated their vulnerability, and they valued the honesty of our project and appreciated the application of mathematics to develop social knowledge. Instead of students walking into the classroom as blank slates, students walked into the classroom with experiences, knowledge, talents, and voices that contributed to the construction of knowledge in the classroom. What is more, instead of students walking through their communities uninterested and looking for trouble, students walked within their community empowered and ready to fight for justice.

Asking the Wrong Questions. Many people ask me how students' MCA (Minnesota Comprehensive Assessment) or ACT scores have changed since the implementation of the

project. They are asking the wrong question. They should be asking how students' lives have changed since the implementation of this framework. Many students have recognized their passion for social justice work and have dedicated their efforts to transform oppressive systems and structures in their community. It has been said "Not everything that is important can be measured, and not everything that can be measured is important." This project is one of those cases. I will not and cannot know the full extent to which this project has impacted my students.

The classroom can inform policy. This project is about uncovering power structures and systems of oppression and finding balance. Our current political climate is not in balance and is greatly influenced by those in power. This work is much bigger than a specific educational issue, it has the potential to impact students in a way that will inform policy as students pursue justice and become politicians. The students have had experiences that engaged their critical thinking and asked them to challenge the status quo. They have experienced the difficulty in exposing patterns built on the mirage of individual circumstance. Whether students become future politicians, community leaders, doctors, teachers, or whatever, this project is designed to influence people, to make them aware and informed.

Outside Research. This project drew on the work of many scholars in fields other than education. Matthew Lieberman and Joshua Aronson are social psychologists. Ta-Nehisi Coates is a national correspondent for the *Atlantic*. Niobe Way and Kent Harber are psychology professors. We need to change how we think about education. This requires that we access research outside the field of education. We need to read and reflect on research

that will help us better understand human behavior. We need to know the world is bigger than our respective schools.

Limitations. Despite the impact and power this project generated, it is important to acknowledge the limitations of the project. Finding current and specific data proved to be one of the most difficult aspects of designing unit challenges. Educators must rely on their community to obtain resources necessary to investigate their community. I had to learn how to ask for help. More specifically, the help I needed required that I cultivate and curate connections with experts and other professionals across different disciplines. These connections eased the acquisition of data and shorten the response time in obtaining data. These experiences helped me to really understand how no individual is smarter than the whole group. We truly only meet our full potential as students and educators when we work with other people.

This project requires collaboration and would be intensely difficult to pull off in isolation. It was critical to rely on my colleagues to troubleshoot content and pedagogy. Several times, I had to consult colleagues on how to connect specific mathematics concepts to a social issue. There were several challenges that I had to call multiple team members to help me. Calling upon a colleague is common. Educators ask for tips on how to support a specific student, or advice on how to phrase a test question, etc. These interactions have their place, but they confuse educators' participation in common practice with best practice. I sought out my colleagues to help me connect a specific mathematics concept to a social issue. I needed their support to become an artist of mathematics. My collegial interactions supported the creation of curriculum that offered my students a more equitable and meaningful experience within mathematics.

Unit challenges require educators to have a flexible schedule in order to implement them so that they are responsive to students, which is difficult when educators are meeting the demands of a pacing schedule determined by a content team made up of members who are not participating in the work. The pacing needs of those not participating in the work are usually following district guidelines. These guidelines are constructed to meet the needs of high-stakes assessments in terms of both content and pacing. Chapter two, Hagopian discussed how high-stakes assessments are used to reinforce White Supremacy and dehumanize students. Therefore, even though we know collaboration and community are essential, unwritten rules and norms exist in teamwork. We can use many of these norms to resist White Supremacy while other norms sustain it.

I am a limitation to my project. I underestimated the power in Coates' work. His articulation of the the continual and instantaneous forgetting of white people's participation in White Supremacy impacts my ability to fully engage in dismantling White Supremacy in mathematics education. Coates states "people who believe themselves to be white are obsessed with the politics of personal exoneration" (2015, p. 97). He goes on to explain that this practice is not built overnight, that it is a "practiced habit" (2015, p. 98). Moreover, Boaler's brain research says this habit can be changed but it takes daily efforts over long periods of time (minimum of six weeks) to recircuit the brain's default pathways (2013). And even when the default pathway is established, in moments of stress or exhaustion we revert to our old pathways (2013). As a white educator, taking on the role of educating students and other teachers, both white and Educators of Color alike, can be problematic. It is incredibly important that I do not allow my achievements to engage my ego and conjure elitism in my approach to the work. When I allow my accomplishments to ignore my whiteness, I am an

agent of White Supremacy. I have learned this lesson many times and know I will have to learn it again in the future. My hope is that the frequency of needing to learn this decreases and the duration in between increases.

In general, white educators are a limitation to the project. White educators must put in work to better understand their whiteness, power, and privilege in life and in the classroom. It is detrimental and dangerous for white educators to engage in this work without understanding the power dynamic with which they operate both in and outside of the classroom. All educators working in our public schools need to have a working knowledge and understanding of race as a social construct that perpetuates the oppression of people.

Just as educators need to understand structures of power and privilege, so do policy makers. Mathematics teachers in Minnesota have an obligation to teach content tied to state standards. Moreover, this project impores eduators to use mathematics content to analyze social issues. The Minnesota state standards can limit the scope to which a social issue is investigated because implementing this project requires educators to specifically connect state designated mathematics to that social issue. This conversation can get muddy when those in power decide what topics are required to uncover the systems that put them in power. We are asking the king to provide his subjects with tools that will be helpful in dethroning him.

Communication of Results

The best way to influence policy is to spread the work to a diverse (diverse does not only mean racially diverse) audience. To spread the framework, I have and will continue to present my work at local and state general education conferences, such as: Minneapolis Equity Institute, Minnesota Educators Association, and at local and national racial justice

conferences, such as: Twin Cities Social Justice Fair and Courageous Conversations. I have also presented at local and state conferences for mathematics teachers, such as: Minnesota Council of Teachers Mathematics (MCTM) and Illinois Council of Teachers of Mathematics (ICTM). I have presented the work to experienced educators and to novice teachers, such as Equity Alliance and University of Minnesota pre-service teacher courses. I have also presented the work with student-presenters who make appealing cases to educators on the imminent need to transform mathematics education in America.

Classroom level work has the power to influence policy since classrooms can influence people. Our classrooms and our world are in need of deep restructuring. The framework, examples, and resources from my project are presented at conferences and workshops. This work will support educators in taking steps to transform and restructure their teaching and learning spaces to offer equitable and high-quality mathematics instruction to all of their students.

Future Projects

Hagopian's work inspired me to really analyze the systems I use to value my students. He described standardized testing as a measurement of access to resources (2014). Homework has troubled me my entire career. Homework completion is a measurement of access to resources for our students. Who has the time? Space? Support? etc. to sit down everyday and complete homework for up to seven courses each day. I want to destruct and rebuild homework. I am conflicted because on one hand, Boaler explains that daily practice is necessary to build strong pathways (2016). On the other hand, my experience has taught me that no matter the incentive, some students do homework and others do not. It is critical to understand how systemic barriers impact homework completion rates.

When I assess homework, I am assessing students access to resources and rewarding students as such. This is emblomatic of White Supremacy in mathematics education in that I am using a system, "homework," to elevate and reward students for something they already have, access to resources, and destruct and punish other students for what they do not have, access to resources. I am building and reinforcing the Myth of Meritocracy through the elevation of the "have" and the destruction of the "have nots." The students with good grades, will leave my classroom with the understanding that they worked hard and they deserved their grades and they will also believe the students who did not pass, did not put in enough effort. I perpetuate the forgetting of structures and systems that created the "haves" and the "have nots" in the first place. I want to restructure homework so that students experience the inherent benefits of daily practice to strenthen and grow their brains but I want a system that fairly assesses students' knowledge and understanding.

Conclusion

Education is problematic in the United States. Education has been said to be the "Great Equalizer" but in fact, it is the "Great Unequalizer." Teachers, schools, districts, and states claim to write policy and design systems with good intentions, but without checks and balances in place to ensure the policy actually results in its intended purpose, it is just that, a good intention. White Supremacy is persistent, horric, and has devasting affects on all of our students. It overrides and preys upon good intentions. Our students are more than the unintended consequences of good intention. They are magnificent and beautiful people with talents, emotions, passion, and purpose. We have a responsibility to fight like warriors for them, with courage and strength, no matter the cost. We are adults and we have an obligation to care for and educate our children.

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Appendix A: Course Learning Targets

Unit 1: Sequences & Series

Approximate Duration: 17 lessons

1.1 I can write a recursive formula for arithmetic, geometric, and shifted geometric sequences.

a. I can recognize a pattern and explain how to find the next 4 terms.
b. I can use multiple forms of recursive notation.
c. I can identify the three parts (rule, term, and domain) of a recursive model.

Minnesota State Math Standards (9.2.2.4)

1.2 I can model and solve relevant real-world problems using recursive sequences and series.

a. I can determine when to use u_0 versus u_1.
b. I can determine how many terms in a sequence are necessary to determine an appropriate recursive model.
c. I can interpret the three parts (rule, term, and domain) of a recursive model in context.
d. I can use recursive formulas to model and solve real-world situations using a graphing calculator.
e. I can find the limit of a decreasing geometric sequence and shifted geometric sequence if it exists.
f. I can use geometric sequences to model growth and decay word problems.
g. I can determine how interest and depreciation can be modeled in a recursive formula.
h. I can use recursive formulas to model loans and investments.
i. I can incorporate compound interest in a recursive and explicit model.

Minnesota State Math Standards (9.2.2.2; 9.2.2.5; 9.2.4.2; 9.2.4.8)

1.3 I can move fluently among multiple representations of recursive sequences.

a. I can determine the common difference/common ration from a graph, table, recursive formula, and explicit equation.
b. I can determine the y-intercept from a graph, table, recursive formula, and explicit equation.
c. I can write an explicit equation from a recursive formula.
d. I can recognize arithmetic, geometric, and shifted geometric sequences from a table, graph, recursive formula, or explicit equation.

Minnesota State Math Standards (9.2.2.3)

1.4 I can express the partial sums of a geometric series recursively.

a. I can generate a table of the partial sums of a geometric series.
b. I can write a recursive rule to model the partial sums of a geometric series.
c. I can use sigma notation to represent the partial sums of a geometric series.
d. I can determine the partial sum of a geometric series.

Minnesota State Math Standards (9.2.2.5)

Unit 2: Function Families

Approximate Duration: 18 lessons

2.1 I can define a function and determine its important aspects.

a. I can identify a practical and theoretical domain and range of a function.
b. I can identify intercepts, zeros, maxima, minima, and intervals of increase and decrease for a function (using equations, tables, and graphs).
c. I can use mathematical notation to describe the domain and range of a variety of functions.
d. I can obtain information and draw conclusions from a graph, table, and equation.
e. I can evaluate a function at a given point.
f. I can determine the rate of change from a graph, equation, or table.
g. I can evaluate compositions of functions.

Minnesota State Math Standards (9.2.1.1; 9.2.1.2; 9.2.1.3; 9.2.1.4)

2.2 I can model a quadratic, square root, & absolute value function using the parent function and move fluently among the multiple representations within each function family.

a. I can identify the parent equation, graph, and table for a quadratic, square root, and absolute value function.
b. I can apply transformations including translations, reflections, stretches, and shrinks to a parent function and determine the resulting graph and/or equation.
c. I can identify the important features of a function to determine which function family best models a given situation.
d. I can determine which function family best models the relationship between two variables.

Minnesota State Math Standards (9.2.1.5; 9.2.1.8; 9.2.1.9; 9.2.2.3; 9.2.2.6; 9.2.3.1)

2.3 I can model a cubic, cube root, & inverse (rational/reciprocal of linear) function using the parent function and move fluently among the multiple representations within each function family.

a. I can identify the parent equation, graph, and table for a cubic and inverse function.
b. I can apply transformations including translations, reflections, stretches, and shrinks to a parent function and determine the resulting graph and/or equation.
c. I can identify the important features of a function to determine which function family best models a given situation.
d. I can determine which function family best models the relationship between two variables.
e. I can identify the asymptotes for the reciprocal of a linear function using symbolical and graphical methods.

Minnesota State Math Standards (9.2.1.7; 9.2.1.8; 9.2.1.9; 9.2.2.6)

Unit 3: Exponential, Power, & Logarithmic Functions

Approximate Duration: 19 lessons

3.1 I can define exponential, power, and logarithmic functions.

a. I can define exponential, power, and logarithmic functions
b. I can make a table for an exponential, power, and logarithmic functions.
c. I can identify and interpret asymptotes for a function.
d. I can write an equation based on the graph and vice versa.
e. I can make statements about the rate of change for a function.

Minnesota State Math Standards (9.2.1.7; 9.2.2.3)

3.2 I can solve equations and simplify expressions involving exponents.

a. I can solve equations with exponents as the variable.
b. I can apply properties of exponents (list will be provided in class).
c. I can represent and solve problems using exponentials (investment growth, depreciation, & population growth).

Minnesota State Math Standards (9.2.2.2; 9.2.4.2; 9.2.4.8)

3.3 I can solve equations with rational exponents and radicals.

a. I can write a root with rational exponents.
b. I can rewrite expressions with rational exponents as expressions involving roots.

Minnesota State Math Standards (9.2.3.1; 9.2.4.7)

3.4 I can solve equations and simplify expressions with logarithms.

a. I can use the definition of logarithm to change between logarithmic and exponential form.
b. I can simplify expressions with logarithms.
c. I can solve equations with logarithms.
d. I can apply the Change-of-base formula.

Minnesota State Math Standards (9.2.4.8)

Unit 4: Quadratics

Approximate Duration: 23 lessons

4.1 I can create equivalent quadratic expressions.

a. I can identify and locate the scale factor of a quadratic.
b. I can identify and use general form, vertex form, and factored form of a quadratic function.
c. I can convert forms by graphing.
d. I can identify and write an equation for the line of symmetry for a quadratic equation.

Minnesota State Math Standards (9.2.1.5; 9.2.3.7; 9.2.4.1)

4.2 I can identify and locate the zeros of a quadratic function.

a. I can identify and use the factored form of a quadratic function.
b. I can factor quadratic equations.
c. I can use the quadratic formula to find the roots of a quadratic in general form.
d. I can expand a binomial product to go from factored to general form.

Minnesota State Math Standards (9.2.1.5; 9.2.1.6; 9.2.2.1; 9.2.3.3; 9.2.4.1; 9.2.4.3; 9.2.4.8)

4.3 I can identify and locate the vertex of a quadratic.

a. I can identify and use the vertex form of a quadratic function.
b. I can recognize perfect square binomials.
c. I can recognize difference of squares binomials.
d. I can "Complete the Square" to go from general to vertex form.

Minnesota State Math Standards (9.2.1.5; 9.2.1.6; 9.2.2.1; 9.2.4.1; 9.2.4.8)

4.4 I can define and apply properties of complex numbers.

a. I define complex numbers.
b. I can add/subtract complex numbers.
c. I can multiply/divide complex numbers.
d. I can use complex conjugates to simplify expressions.
e. I can find and check solutions to quadratic equations.

Minnesota State Math Standards (9.2.3.6; 9.2.4.1; 9.2.4.3; 9.2.4.8)

Unit 5: Polynomials

Approximate Duration: 18 lessons

5.1 I can identify important features of higher-degree polynomials.

a. I can determine if an expression represents a polynomial.
b. I can write a polynomial in standard form.
c. I can name a polynomial by its degree and by the number of terms.
d. I can recognize the roots of a polynomial function from its graph and equation.
e. I can use notation to describe intervals of increase/decrease.
f. I can identify local minima, maxima, and end behavior of polynomials.
g. I can write an equation given its zeros and y-intercept.

Minnesota State Math Standards (9.2.1.6; 9.2.4.3)

5.2 I can perform operations on polynomials.

a. I can add, subtract, and multiply polynomials.
b. I can divide polynomials using long-division and synthetic division.
c. I can use polynomial operations to solve word problems.

Minnesota State Math Standards (9.2.3.2; 9.2.3.3)

5.3 I can factor rational functions to simplify expressions.

a. I can add, subtract, multiply, and divide rational expressions.
b. I can factor polynomials.
c. I can simplify and solve rational expressions.

Minnesota State Math Standards (9.2.3.4)

Unit 6: Matrices & Inequalities

Approximate Duration: 24 lessons

6.1 I can perform matrix operations.

a. I can create a polygon matrix.
b. I can express the translation of a polygon with matrices.
c. I can define vocabulary associated with matrices (dimension, row, column, entry).
d. I can perform matrix addition.
e. I can perform matrix multiplication.
f. I can perform scalar multiplication.

Minnesota State Math Standards (none – prerequisite material for pre-calculus)

6.2 I can solve a system of equations using matrices.

a. I can write a system of equations as a matrix (augmented matrix).
b. I can use row-reduction to solve a system of equations.
c. I can solve a system of equations using inverse matrices.
d. I can perform matrix multiplication.
e. I can identify the identity matrix.
f. I can define an inverse matrix.
g. I can use matrix inverse notation.

Minnesota State Math Standards (9.2.3.7; 9.2.4.8)

6.3 I can solve a system of inequalities.

a. I can graph an inequality.
b. I can graph a minimum of 3 inequalities to find a feasible region.
c. I can determine the vertices of the feasible region.
d. I can find the optimal value.
e. I can determine the reasonableness of a solution based on the graph.
f. I can represent contextual problems using inequalities.
g. I can write constraints (inequalities) for a linear programming problem.
h. I can determine the reasonableness of solution based on the context of a problem.

Minnesota State Math Standards (9.2.3.7; 9.2.4.1; 9.2.4.4; 9.2.4.5; 9.2.4.6; 9.2.4.8)

Unit 7: Probability

Approximate Duration: 25 lessons

7.1 I can describe and calculate chance behavior with a probability model.

a. I can determine probability from two-way tables and tree diagrams.
b. I can construct Venn Diagrams and determine probabilities.
c. I can use basic probability rules, including the complement rule and the addition rule for mutually exclusive events.

Minnesota State Math Standards (9.4.3.1; 9.4.3.6; 9.4.3.7; 9.4.3.8)

7.2 I can interpret and calculate conditional probabilities.

a. I can use notation to describe and compute conditional probabilities.
b. I can calculate conditional probabilities of events using a two-way tables, Venn Diagrams, and tree diagrams.

Minnesota State Math Standards (9.4.3.5; 9.4.3.6; 9.4.3.7; 9.4.3.8)

7.3 I can determine if two events are independent.

a. I can determine if two events are independent.
b. I can calculate the probability of multiple independent events.
c. I can calculate the probability of compound events.
d. I can determine if two events are mutually exclusive.
e. I can distinguish between intersections and unions.
f. I can apply probability concepts to make informed decisions in real-world situations.

Minnesota State Math Standards (9.4.3.5; 9.4.3.6; 9.4.3.7; 9.4.3.8; 9.4.3.9)

7.4 I can design and perform simulations.

a. I can define experimental probability, trials, and events.
b. I can define theoretical probability, outcomes, and randomness.
c. I can tell the difference between experimental and theoretical probabilities.
d. I can interpret probability as a long-run frequency.
e. I can explain the importance of randomness in simulations and other experiments.
f. I can apply probability concepts to make informed decisions in real-world situations.

Minnesota State Math Standards (9.4.3.2; 9.4.3.3; 9.4.3.4; 9.4.3.8)

Fierst, Morgan (2017).

Appendix B: Course Pacing Guide

1ST Quarter (44 days) 2017-2018

Week	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
1	**August 28** Community Building Name Tents	29 Community Building Name Tents	30 Community Building Name Tents	31 Community Building Name Tents	**September 1** Community Building Name Tents
2	4 **NO SCHOOL** Labor Day	5 Community Building	6 Community Building	7 Community Building	8 Community Building
3	11 Recursion	12 Recursion	13 Appreciation	14 Depreciation	15 Savings
4	18 Loans	19 Kidneys & Medicine	20 Multiple Representations	21 Multiple Representations	22 Series
5	25 Series	26 Series	27 Unit Challenge	28 Unit Challenge	29 Review
6	**October 2** Review	3 Unit 1 Assessment	4 Function Intro	5 Function Notation, Domain & Range	6 Function Composition
7	9 Function Composition	10 Function Composition	11 Function Families	12 Parent Functions	13 Parent Functions
8	16 Translations	17 Translations	18 **NO SCHOOL** CONFERENCES	19 **NO SCHOOL** State Fall Conference Day	20 **NO SCHOOL** Conference Conversion Day
9	23 Reflections	24 Vertical Stretches & Shrinks	25 Vertical Stretches & Shrinks	26 Horizontal Stretches & Shrinks	27 Rational & Periodic Functions
10	30 Review	31 Review	**November 1** Unit 2 Assessment 1st Quarter Ends	2 **NO SCHOOL** Teacher Prep/PD	3 **NO SCHOOL** Record Keeping Day

2nd Quarter (44 days) 2017-2018

Week	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
1	6 Persistence Work	7 Persistence Work	8 Exponential Functions	9 Power Functions	10 Exponential vs. Power Functions
2	13 Properties of Exponents	14 Properties of Exponents	15 Properties of Exponents & Roots	16 Rational Exponents & Roots	17 Rational Exponents & Roots
3	20 Unit Challenge	21 Unit Challenge	22 **No School - Fall Break**	23	24
4	27 Review	28 Review	29 Unit 3-Part 1 Assessment	30 Logarithmic Functions	**December 1** Logarithmic Functions
5	4 Properties of Logarithms	5 Unit Challenge	6 Unit Challenge	7 Unit 3-Part 2 Assessment	8 Quadratic Patterns
6	11 Quadratic Patterns	12 Quadratic Patterns	13 Equivalent Forms	14 Equivalent Forms	15 Equivalent Forms
7	18 Scale Factor & Y-intercept	19 Roots & Factored Form	20 Roots & Vertex Form	21 Roots & General Form	22 Roots & Graphing
	WINTER BREAK * December 25, 2017 – January 5, 2018				
8	**January 8, 2018** Roots & Factoring	9 Roots & Factoring	10 Roots & Factoring	11 Roots & Factoring	12 Vertex Average of the Roots
10	15 **NO SCHOOL** MLK Day	16 Vertex Completing the Square	17 Vertex Completing the Square	18 Vertex Completing the Square	19 Review
10	22 Review	23 Review	24 Unit 4 Assessment 2nd Quarter Ends	25 **NO SCHOOL** Teacher Prep/PD	26 **NO SCHOOL** Record Keeping

3rd Quarter (42 days) 2017-2018

Week	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
1	29 Classifying Polynomials	30 Important Features of Polynomials	31 Important Features of Polynomials	**February 1** Important Features of Polynomials	2 Polynomial Operations
2	5 Desmos	6 Desmos	7 Polynomial Operations	8 Polynomial Operations	9 Algebraic Fractions
3	12 Algebraic Fractions	13 Algebraic Fractions	14 Algebraic Fractions	15 Review	16 **NO SCHOOL** Parent Teacher Conferences
4	19 **NO SCHOOL** President's Day!	20 Unit Challenge	21 Unit Challenge	22 Review	23 Unit 5 Assessment
5	26 Intro	27 Matrix Operations	28 Matrix Operations	**March 1** Practice	2 Solving Systems
6	5 Row Reduction Method	6 Calculator Day	8 Row Reduction	9 Solving Systems with Inverse Matrices	9 Solving Systems with Inverse Matrices
7	12 Solving Systems with Inverse Matrices	13 Solving Systems with Inverse Matrices	π Day * 14 Review	15 Review	16 Unit 6 Assessment Part 1
8	19 Graphing Inequalities	20 Systems of Inequalities	21 Linear Programming	22 Linear Programming	23 Unit Challenge
9	26 Unit Challenge	27 Review	28 Review	29 Unit 6 Assessment Part 2 3rd Quarter Ends	30 **NO SCHOOL** Record Keeping Day
	SPRING RECESS * April 2- April 6, 2018				

4th Quarter (46 days) **2017-2018**

Week	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
1	**April 9** Randomness & Probability	10 Randomness & Probability	11 Two Way Tables	12 Two Way Tables	13 Venn Diagrams
2	16 Venn Diagrams	17 Tree Diagrams	18 Conditional Probability	19 Multiplication Rule	20 Practice
3	23 Special Multiplicatio n Rule	24 Independence	25 Independence	26 Review	27 Review
4	30 Review	**May 1** Unit 7 Assessment	2 Simulations	3 Simulations	4 Simulations
5	7 Simulations	8 Simulations	9 Unit Challenge	10 Unit Challenge	11 Unit Challenge
6	14 Student Capstone Projects	15 Student Capstone Projects	16 Student Capstone Projects	17 Student Capstone Projects	18 Student Capstone Projects
7	21 Student Capstone Projects	22 Student Capstone Projects	23 Student Capstone Projects	24 Student Capstone Projects	25 Student Capstone Projects
8	28 **NO SCHOOL** Memorial Day	29 Student Capstone Projects	30 Student Capstone Projects	31 Student Capstone Projects	**June 1** Student Capstone Projects
9	4 Unit Circle	5 Unit Circle	6 Unit Circle **STUDENT EXHIBITION NIGHT**	7 Unit Circle	8 Review
10	11 Review	12 Unit Assessment **Last Day!**	13 **NO SCHOOL** Record Keeping Day	14 **NO SCHOOL**	15 **NO SCHOOL**

Fierst, Morgan. (2017).

Appendix C: Name Tent Feedback Form

First Week Feedback Form

Name____

Use this form to communicate with me. This is a place for you to comment, question, and make suggestions about class activities and content. I greatly appreciate your time. Please, turn this feedback form in at the end of class and it will be returned the next day of class. The nametag part of this form will be used for the rest of the school year.

Day 1	**Day 2**	**Day 3**	**Day 4**	**Day 5**
Comments: **(student)**	Comments:	Comments:	Comments:	Comments:
Response: **(teacher)**	Response:	Response:	Response:	Response:

Adapted from AVID.

Appendix D: Preferred Names Checklist

Preferred Name	Phonetic Spelling
Morgan	More-gen
Caitlin	Kate-lynn
Keziah	Kah-zye-ah
Koah	Ko-ah (sounds like Noah)
Dridge	Drid-jeh (sounds like bridge)
Petra	Pee-tra
Katrina	Ka-treen-ah
Yasmin	Yeah-zz-mean
Ricarda	Rah-card-ah
Maren	Mare-en (sounds like Karen)
Jersahi	Jer-sah-hee
Elias	El-ee-us

	Number of Names I know
Thursday	
Friday	
Monday	
Tuesday	
Wednesday	

Fierst, Morgan (2017).

Appendix E: Unit 1 Challenge Question

Unit 1 Challenge

The Question

To what extent is there racial discrimination in mortgage lending? How does access to fair and equitable lending practices impact my community?

Our Questions

What do we need to know?

Appendix F: Student Generated Questions

Unit 1 Challenge

The Question

To what extent is there racial discrimination in mortgage lending? How does access to fair and equitable lending practices impact my community?

Our Questions

What do we need to know?

What is subprime lending?
How much does the house cost?
How much interest are we paying?
How much money do I make?
What's the "down payment"?
What is a down payment?
What are the terms of the mortgage?
How can we keep track of our payments?
How do subprime loans work?
Who gave out the loans?
Were most people eligible for prime loans?
How many people have been foreclosed on?
What does it mean to qualify for a loan?
What are the criteria to qualify for a loan?
What is the difference between different types of loans?
What support does the bank give in tracking/paying the loan?
How many loans are given out to blacks?
How many loans are given out to whites?
Does location matter when it comes to cost?
Do all banks have the same problem?
Does loan amount matter?
What can we do?
What is the pattern for usual lending?
Who is this affecting?
Why is this happening?
Why is this topic significant?
How many white people were turned down?
What is the population of Minneapolis by race, who use subprime loans?
Why do blacks and Hispanics and other communities have to go through all the hoops to get a loan?

What is racism?
How many loans did they give out?
Do white people make that much more?
What are the requirements to get a loan?
Are there programs designed to benefit families close to foreclosure?
How do foreclosures work?
How often do foreclosed homes get broken into?
What are the loan policies?
What is the average fee for white people? Nonwhite people?
What are comparison rates?
How does this affect the community?
How do loans differ between different racial communities?
What is prime lending?
What are the difference white people pay vs. any other race?
Why did it take so long to bring attention to?
Will this situation ever turnaround?
How long does it take to pay off the loan?
How much can we pay in order to finish our payments?
What happens if I get stuck on my payments?
What are the demographics?
What is the ratio of whites to people of color that go into foreclosure?
What is a typical mortgage?
Do you have to give your race to apply for a loan?
Do they research/educate the subject?
How do they know what your race is?
What would evidence look like to support this claim?
Is this unconstitutional?
How do mortgages work?
How many minorities got subprime loans?
Why would they target the black and Hispanic communities?
Why didn't the twin cities residents complain about the issue?
How many subprime lenders were involved?
Which communities had the most complaints reported?
How did people know they were being discriminated?
Who had benefited the most?
Could this be a coincidence?
What are the education levels of people getting loans?
Why would banks give unreasonable loans?
What are the loan statistics for the last ten years?
Why would Wells Fargo settle if they are going to deny claims?
What part of the country is segregation most common?
How does this issue affect Minneapolis?
What is the definition of census?
Why is it that, neighborhoods where more people own their homes tend to be "better?"
What does "faceless algorithms" mean? ("Even in this age of *faceless algorithms* that guide investment decisions.")

Why can a white family get a loan and not a black family?
What does "racial composition of the neighborhood is a strong predictor of mortgage activity" mean?
What is "America's Wealth gap"?
What does the National Community Reinvestment Coalition do?
How big is the racial wealth gap?
Why are we studying this?
Why is the wage gap with race less talked about than the wage gap with gender?
Are people doing anything to make it better?
What are they doing?
Why do we still have racial discrimination?
Is it like this in my neighborhood?
Who makes the decision of whether or not someone can get a loan or not?
How much higher of a population? ("A higher population of African American residents correlates with fewer mortgage loan organizations.")
What is the difference between racial categories acceptance of loans? (White vs. Black)
What is the diversity of the neighborhoods majority/minority?
How does credit score play a role in this?
What does census tracts have to do with this?
Why aren't as many black people being accepted for loans and mortgages?
Does the area of the house affect who gets to live there?
How many people a year don't get accepted because of race?
Is there a certain bank not accepting loans?
Is this more prevalent depending on location?
Do you have to be a citizen?
What is the evidence behind discrimination in mortgage lending?
If a black family was of a higher income than a white family, would they have higher chance of getting the loan?
What does algorithms mean?
In segregated areas, how many people own their home like in predominantly black area vs. predominately white?
In those same areas, how many people applied for a mortgage?
What percent of white/African Americans that apply for mortgage loans?
How many people apply for loans per year?
What do they mean by "normal social and economic measures"?
How does credit affect mortgage lending based on the individual?
Are the families who are affected aware of this or is it being covered up?
How are people resisting and fighting back if this is "one of the deep routes of America's racial wealth gap"
How long has this been going on for?
Where in the US is the gap the smallest?
What neighborhoods are they getting the data from?
What race was the author of the first article?
What's the wealth gap between white families and other races such as Latino or native American?

Historical Background: Has anything happen in the past areas that may make the bank resistant?

What race reviews the applications? Is it mixed?

Do the White people in the same area get loans?

Does it depend on the time of year you apply?

Is there a difference in price? Does the price of the house matter?

Is there any expectations or standards?

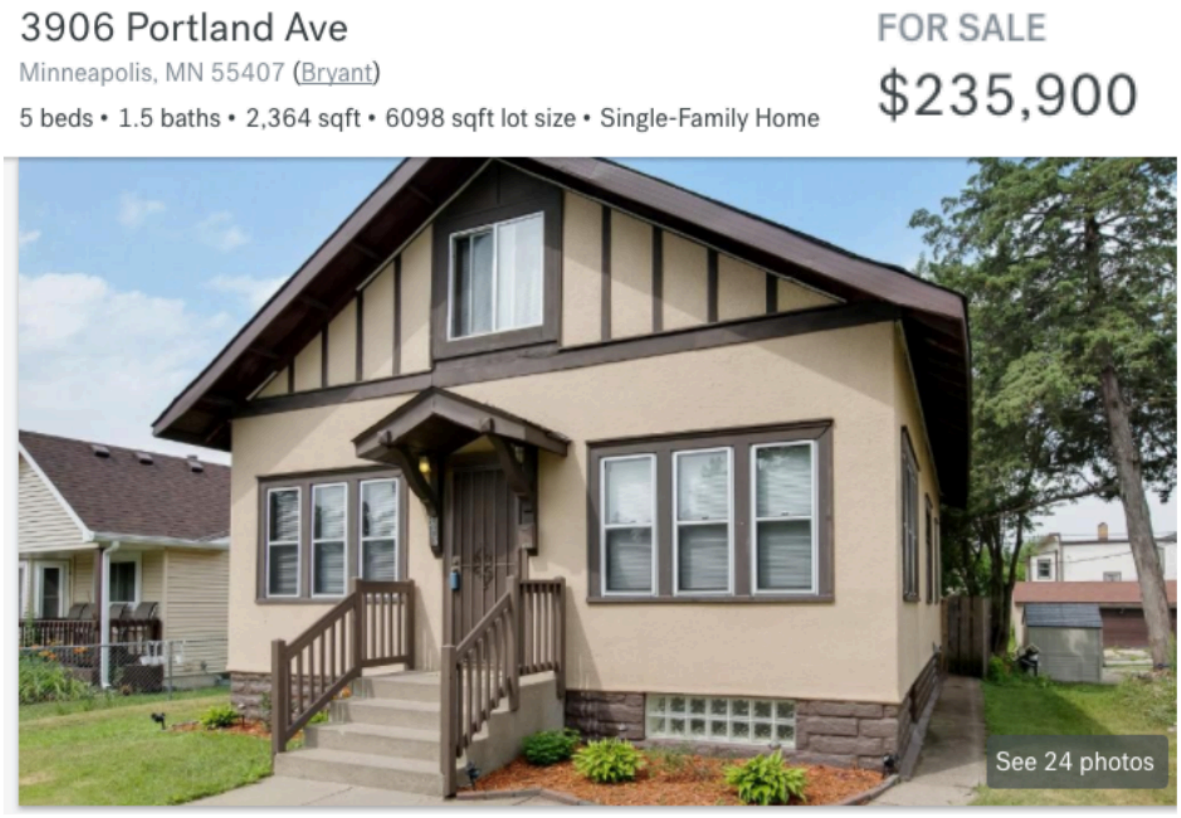
Where do they/we get information from?

What would bank policies look like if they were equitable?

Appendix G: Unit 1 Chapter Challenge

Housing Investigation

You plan to borrow $235,900 (September 2018 Minneapolis Median Home Price) to purchase a new home. The investment must be paid off in 30 years (360 months). The bank charges an annual interest rate of **4.5%** compounded monthly.



Trulia.com. (2017).

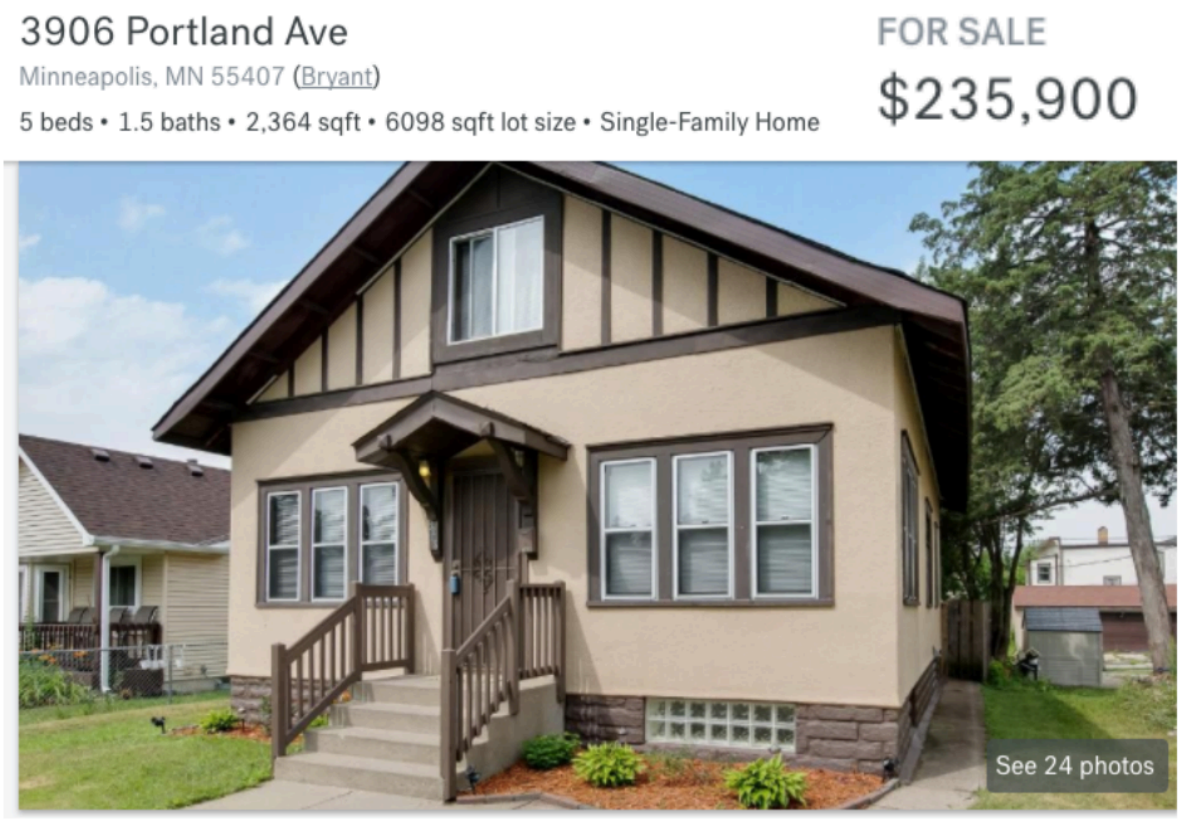
1. Experiment with values for the monthly payment. What monthly payment allows you to pay the loan off in exactly 360 months? How did you determine this payment (i.e. what is your recursive formula)?

2. How much do you actually pay for your home?

3. A household is considered cost-burdened when 30% or more of its monthly gross income is dedicated to housing. Based on your monthly payment, how much would your monthly gross income need to be so you are not considered "cost-burdened?"

Housing Investigation

You plan to borrow $235,900 (September 2018 Minneapolis Median Home Price) to purchase a new home. The investment must be paid off in 30 years (360 months). The bank charges an annual interest rate of **5.5%** compounded monthly.



Trulia.com. (2017).

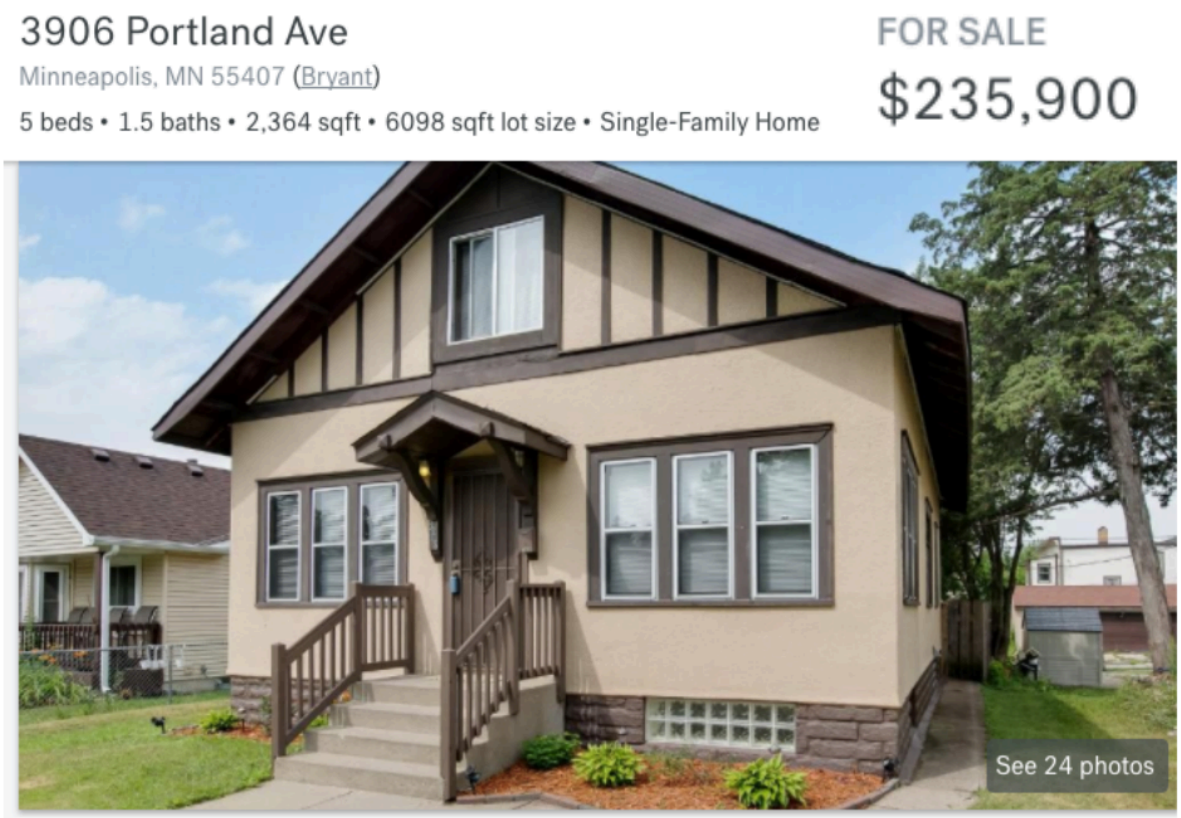
1. Experiment with values for the monthly payment. What monthly payment allows you to pay the loan off in exactly 360 months? How did you determine this payment (i.e. what is your recursive formula)?

2. How much do you actually pay for your home?

3. A household is considered cost-burdened when 30% or more of its monthly gross income is dedicated to housing. Based on your monthly payment, how much would your monthly gross income need to be so you are not considered "cost-burdened?"

Housing Investigation

You plan to borrow $235,900 (September 2018 Minneapolis Median Home Price) to purchase a new home. The investment must be paid off in 30 years (360 months). The bank charges an annual interest rate of **6.5%** compounded monthly.



Trulia.com. (2017).

1. Experiment with values for the monthly payment. What monthly payment allows you to pay the loan off in exactly 360 months? How did you determine this payment (i.e. what is your recursive formula)?

2. How much do you actually pay for your home?

3. A household is considered cost-burdened when 30% or more of its monthly gross income is dedicated to housing. Based on your monthly payment, how much would your monthly gross income need to be so you are not considered "cost-burdened?"

Solution Page

Group Members:

Recursive Formula:

Total Amount Paid for Home (Payment x 360):

Monthly Income needed to avoid being cost-burdened:

Appendix H: Unit 1 Results

Results

Interest Rate	**4.5%**	**5.5%**	**6.5%**
Monthly Payment	**$1,195.27**	**$1,339.41**	**$1,491.05**
Total Amount Paid for the Home	**$430,297.20**	**$482,187.60**	**$536,778.00**
Total Interest Paid	**$190,797.20**	**$242,687.60**	**$297,278.00**
Minimum Monthly Gross Income (to avoid being "cost-burdened"	**$3,984.23**	**$4,464.7**	**$4,970.17**
Minimum Yearly Gross Income (to avoid being "cost-burdened"	**$47,810.76**	**$53,576.40**	**$59642.04**

Fierst, Morgan. (2017)

Appendix I: Critical Learning Project

Advanced Algebra: Social Justice and Mathematics Critical Learning Project

Objective:
Students will create their own critical learning projects (similar to Chapter Challenges). Students will identify an equity issue within their community. Groups will research the issue and use mathematics to create a deeper understanding of the identified issue. Students will create Public Service Announcements to create awareness for the issue of concern.

Project Details:
This project is composed of two components. Students will submit a mathematical justification that provides a deeper understanding of the issue. Based on the students' research and findings, groups will then create a PSA that will be filmed and edited by the group, to create awareness for their issue.

Part 1: Mathematics

Groups will conduct research to identify key elements of the issue. Students are encouraged to conduct interviews and analyze data to better understand why the issue exists and to seek possible solutions. The most important piece of the report will be the use of mathematics to better understand the impact this issue has on the community. (i.e. What do these issues mean to us?). Students will need to clearly identify which learning targets are incorporated in their project.

Key components of Part 1:

- Clearly defined issue
- Key elements of the issue are identified and supported by research
- Mathematics is used to create a deeper understanding
- Learning Targets are identified
- Research is cited using APA format

Part 2: PSA

Student groups will create PSA that are NO MORE than two minutes in length to create awareness for their issue of focus. A storyboard (script/plan) for the PSA is due before any filming can take place. The mathematics used in part 1 will be the basis for the PSA.

Timeline
5/16 – All groups submit their topic of concern
5/23 – Mathematical Justification
5/25 – PSA Story Boards (plans/scripts) are due
6/01 – Final PSA is submitted

Resource Websites:

1. City of Minneapolis
   http://www.ci.minneapolis.mn.us/

2. Minnesota Compass
   http://www.mncompass.org/twincities/

3. Minnesota Human Rights
   http://hrusa.org/thisismyhome/

4. Close the Gap – University of MN
   http://hrusa.org/closethegap/main.php

5. Institute on Race & Poverty
   http://www.irpumn.org/

6. Radical Math
   http://radicalmath.org/

7. Teaching Mathematics for Social Justice
   http://www.wfu.edu/~mccoy/socialjustice/

8. Rethinking Schools
   http://www.rethinkingschools.org/ProdDetails.asp?ID=0942961544

9. Human Rights
   http://www.un.org/en/documents/udhr/

10. UN Human Rights
    http://www.un.org/en/rights/

11. Gap Minder – Statistical Analysis Site
    http://www.gapminder.org

Mathematics & Social Justice

DATE 2017 Classroom Instruction **Assignment** *What's DUE?*	CRITICAL LEARNING PROJECTS: This is a group project and all group members are expected to contribute in meaningful ways. ONLY projects that are completed on time are accepted. NO EXCEPTIONS!			
MON	**TUES**	**WED**	**THURS**	**FRI**
14-May	**15-May**	**16-May**	**17-May**	**18-May**
Project Introduction	Groups Meet Brainstorm Ideas & Research Begins	Groups Meet Brainstorm Ideas & Research Begins *Due: Topics*	Groups Meet Research *Mobile Mac Lab*	Groups Meet Research *Mobile Mac Lab*
21-May	**22-May**	**23-May**	**24-May**	**25-May**
Groups Meet Mathematical Justification *Mobile Mac Lab*	Groups Meet Mathematical Justification *Mobile Mac Lab*	Flip Camcorder & iMovie Information Session *Mobile Mac Lab*	Groups Meet Scripts/Plans for PSA content ***Due: Storyboard***	Groups Meet Start Filiming *Mobile Mac Lab*
28-May	**29-May**	**30-May**	**31-May**	**1-Jun**
NO SCHOOL *Mobile Mac Lab*	Groups Meet Filming *Mobile Mac Lab*	Groups Meet Wrap up filming & start editing *Mobile Mac Lab*	Groups Meet Editing *Mobile Mac Lab*	Groups Meet Finish up!!! Yay!! ***Due: PSAs***
4-Jun	**5-Jun**	**6-Jun**	**7-Jun**	**8-Jun**
		Student Exhibition Night 5-8pm		

Critical Components:
Issue Identification
Mathematical Justification
Storyboard
PSA

Save the Date!!! **June 6th** will be our project exhibition night! Dinner will be provided. Stay tuned for details.

Fierst, Morgan. (2017).

Group Reflection

Our Group topic:

Mathematics Incorporated:

Things that are going well:

Things that are frustrating:

This week's game plan:

Wednesday:

Thursday:

Friday (Projects are due):

Individual Reflection Name: _____

Write your thoughts about your experience with the entire project.

- How did this project help you to understand your community better?
- How did this project influence your perception about the importance and usefulness of mathematics?
- What advice would you give to future students who will take part in this project?
- What have you learned about yourself?
- What questions does this project have you asking?

Appendix J: Student Exhibition Night Brochure

Keeping it in the Community

Mathematics & Social Justice

Advanced Algebra
Morgan Fierst
morgan.fierst@mpls.k12.mn.us

South High School
3131 – 19th Avenue South
Minneapolis, MN 55407

South High Students Present:
Social Justice and Mathematics

Student Video Project Topics

Adoptions
Wealth Disparity & Population Density
Wealth Disparity & Taxes
AIDS/HIV in MN
Race in Politics
Ban the Box & Unemployment
Unemployment in MN
College Graduation Rates
College Debt vs. Income
Technology vs. Achievement
Test Scores vs. Spending
Poverty & MCAs
Race to College
AP Cost Savings
AP Required Courses
South's Budget
Achievement Gap
HS Graduation Rates
Integration & Public Schools
School Segregation
Lunchroom Segregation
Racial Profiling
Bullying at South
South's Dress Code Enforcement

Advanced algebra students created public service announcements, driven by course level mathematics, for their community.

Advanced algebra videos can be found on YouTube Channel: "SJM Fierst"
http://www.youtube.com/channel/UCjnDe8HHsvvZKTabEmkVGsw

Please subscribe and provide feedback. New videos and projects will be updated annually.

Fierst, Morgan. (2017).