ACCEPTANCE

This dissertation, SEEKING EQUITY IN STEM: BLACK HIGH SCHOOL STUDENTS, was prepared under the direction of the candidate's Dissertation Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree of Doctor of Education in the School of Education, Concordia University Irvine.

Belinda Dunnick Karge, PhD
Committee Chair

Catherine Webb, EdD
Committee Member

LaTanya Manuel, EdD
Committee Chair

The Dissertation Committee, the Dean, and Executive Director of the Doctor of Education Program of the School of Education, as representatives of the faculty, certify that this dissertation has met all standards of excellence and scholarship as determined by the faculty.

Kent Schlichtemeier, EdD
Dean

Dwight Doering, PhD
Executive Director

COPYRIGHT PERMISSION
AGREEMENT

Concordia University
Library 1530 Concordia
West
Irvine, CA 92612

I, Fréda Antoine , warrant that I have the authority to act on any copyright related matters for the work, SEEKING EQUITY IN STEM: BLACK HIGH SCHOOL STUDENTS, dated October 12, 2021 to be included in the Concordia University Library repository, and as such have the right to grant permission to digitize, republish and use the said work in all media now known or hereafter devised.

I grant to the Concordia University Library the nonexclusive worldwide rights to digitize, publish, exhibit, preserve, and use the work in any way that furthers the educational, research and public service purposes of the Concordia University.

This Agreement shall be governed by and interpreted in accordance with the laws of the State of California. This Agreement expresses the complete understanding of the parties with respect to the subject matter and supersedes all prior representations and understandings.

ACCESS RESTRICTIONS
My electronic thesis or dissertation can be made accessible via the Concordia University Library repository with the following status (select one):

☑ Option 1: Provide open access to my electronic thesis or dissertation on the internet.

□ Option 2: Place an embargo on access to my electronic thesis or dissertation for a given period from date of submission (select one):

□ 6 months □ 1 year □ 3 years

Permission Granted By:

Fréda Antoine
Candidate's Name *(as appears in academic records)*

Signature of Candidate

10/8/2021
Date

Freda.antoine@eagles.cui.edu
E-mail address

VITA

Fréda Antoine

ADDRESS 1530 Concordia West
Irvine, CA 92612
freda.antoine@eagles.cui.edu

EDUCATION

EdD	2021	Concordia University Irvine Educational Leadership
MA	2011	Concordia University, Irvine Education Administration
MA	2005	Pepperdine University, Malibu Education
BA	1998	Saint Francis College, Brooklyn Biology

PROFESSIONAL EXPERIENCE

2020-Present	Gifted and Talented Education (GATE) Program Coordinator
2019-2020	WASC Accreditation Team Co-Lead Teacher
2019-2020	Doctorate of Education Dissertation Poster Presentation Association of California School Administrators Presenter
2017- Present	Learning Management System -Schoology Onsite Trainer/LMS Champion
2008-Present	Mathematics Engineering Science Achievement (MESA) Coordinator
2006-2019	School of Mathematics, Science & Technology Small Learning Community Lead Teacher

ADDITIONAL PROFESSIONAL DUTIES

2003-Present	Teacher/ Science Department Chairperson Fairfax High School Los Angeles Unified School District
2000-Present	Club Sponsorships/Literacy Cadre Member/AVID Teacher Fairfax High School & Thomas Jefferson

SEEKING EQUITY IN STEM: BLACK HIGH SCHOOL STUDENTS

by

Fréda Antoine

A Dissertation

Presented in Partial Fulfillment of
Requirements for the
Degree of
Doctor of Education
in
Educational Leadership
May 15, 2021

School of Education
Concordia University Irvine

ABSTRACT

This study was an examination of current Black participation in STEM and education. The purpose of this mixed method research study is to understand the possible reasons for low enrollment rates for Black high school students in STEM secondary courses. A historical perspective on the marginalization of this sub-group first established the relevance of this study. The research methods involved using a broad survey of students at an urban high school in Southern California, followed by an interview of Black students who were open to sharing their past experiences. The distinct age groups of the populations came from the 11th and 12 grade classes, with a reliable percentage of the population participating. Comparisons were given between the different sub-groups who partook in the survey, to delve into any differences in how Black students at the school perceived themselves, received class information, and motivation to take upper division STEM courses. The study found that Black students were represented in required STEM classes and underrepresented in high school STEM electives. Doubt, lack of encouragement and ineffective recruitment contributed to low participation. It also found apathy and an entrenched mindset of distress, which created a cyclical effect fueling a culture of exclusion. Lastly, the fear of failure, isolation and minimal support kept Black students out of these classes and subsequently out of the path to STEM careers.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENTS

Thank you to dissertation committee for taking to the time to guide, share your thoughts and support me through this process. Dr. Manuel, your insights continue to help me be open to other ways we can support teachers and parents. Dr. Webb, you started me on this journey and had me think of the various readers this dissertation may impact. I thank you for guiding me where I needed to be. Dr. Karge, your laughter, structure and encouraging words helped me more than you will ever know. You are the space of support and grace. When it looked dire, you helped see the possibility every time. Thank you.

To my supportive husband, Gene, thank you for your positivity, love, and consistent encouragement. You had a front row seat to life's unexpected events. With every barrier I encounter, your reassurance was what I needed to continue in my journey through this program and life. Thank you.

To my parents, thank you for instilling the importance of education in me early on in life. School came first and I had to do my best. Although you never said explicitly, I had to go to college it was always understood that it was the expectation. I recognized its value and the access it provides. Dad, your degrees on the wall were the model and always in the back of my mind. Mom, thank you for all the sacrifices you made. I watch you work tirelessly to provide for me and kept me company as I did my homework throughout my schooling. You nurtured my growth and development and have been my rock for so long. I miss you. I have no doubt the lessons you and dad taught me impacted career path and my desire to help others.

To my sweet Olivia, you are my new muse and my heart. Your laughter and inquisitive nature fill my day. You are funny and full of energy. It continues to be a joy to watch you learn, explore and be your amazing self. Thank you for helping take a break and enjoy our time.

CHAPTER 1: INTRODUCTION

The researcher's main intention was to discover why so few Black students enter pathways that lead to careers in STEM. This dissertation explored this issue from the perspective of Black high school students and their peers. It aimed to find out what their experiences are in STEM classes. Why do they think they are under-represented in STEM classes and why do they opt not to declare STEM majors when applying to college? This research contributed to supporting student access. It explored why there is a lack of Black participation in STEM. Sharing the findings as perceived by upperclassmen secondary students can inform the next steps to supporting initiatives aimed to increase involvement. This study inspired schools to take steps to eliminate the equity gap contributing to Black students being under-represented in STEM courses.

Science plays a role in our daily lives. From cooking and recycling to understanding weather reports and figuring out a city map to using computers, these innovations influence our future perceptions. No longer can science literacy be a luxury or an advantage. It is not only essential but significant in navigating our world. It was no surprise that we are connected to our technology as we navigate from the Industrial Age into the Informational Age. Our industries have also transformed. The pathway to careers in Science, Technology, Engineering, Mathematics (STEM) is open to all high schoolers.

The US economy counts on its workers' growth and competitiveness to lead the world in economic prosperity (Committee for Economic Development of the Conference Board, 2019; National Research Council, 2011; Noonan, 2017). Apart from this, prosperity originates from the increase of STEM innovation and, most importantly, STEM jobs. According to the US Congress Joint Economic Committee, keeping up with the growing trend of available STEM positions

keeps countries and multi-national corporations in a position to stay relevant (U.S. Congress Joint Economic Committee, 2012). "Technological discovery helped us become the world's most significant economic power. Scientific and medical breakthroughs helped us become the greatest source of hope around the world," said President Obama at the fifth White House Science Fair (Jones, 2015, p.7). The U.S. policymakers see STEM education as a high priority and a crucial asset to becoming a world leader. Black Americans have contributed to the advancement of STEM and continue to be an untapped resource that can fill the open positions needed to remain at the forefront of STEM (American Association for the Advancement of Science, 2001; Young et al., 2017). Historically, their contributions continued to impact daily life. For example, Fredrick McKinley invented refrigerated truck systems, and Garrett Morgan developed the third warning traffic light. Many were unaware of the involvement of Benjamin Banneker in city planning of the U. S. capital, Washington D. C. (White House Historical Association, 2020). Alexander Miles designed automatic elevator doors, and Gladys West's development of GPS technology are just a few of the STEM advances attributed to Black Americans (Hill, 2018; Morgan, 2020). Over the past five decades, estimates showed the STEM workforce exploded with numbers of 200,000 to 4.8 million positions (Hoffman et al., 2010). From 2000 to 2010, STEM jobs increased by 7.9%. While in contrast, in the same period, non-STEM employment gained 2.6 % (Langdon et al., 2011). According to the U. S. Bureau of Labor Statistics, 8,650,000 is projected in the US's STEM workforce by 2018 (U. S. Bureau of Labor Statistics, 2020). Open STEM positions were expected between 2014 and 2024 to increase by 17%, whereas non-STEM jobs will expand by 12% (Ouimet, 2015). Black participation had shifted from STEM to non-STEM employment despite their past contributions (Career Academy Network, 2012; Funk & Parker, 2018). This statistic was puzzling to the researcher. Why is it

that Black persons are not entering STEM professions?

Employers were looking to hire from within the STEM field disciplines despite the labor market showing tightening signs. A 2015 survey conducted by the National Association of Colleges and Employers (NACE) stated employers planned to hire 9.6% more graduates for their US. Companies than they did from the class of 2014 (Adams, 2015). The U. S. economy hiring projections showed economic opportunities for Black students. When NACE asked about the targeted hires, employers would make, and employers look for critical applicants' critical traits. An engineering degree topped the list of most interest in STEM degrees and majors. According to the NACE 2015 study, about 72% of the companies looked to hire students from the engineering discipline, and 68% are interested in business majors and computer science majors comprise 58% of the total respondents. Eleven percent of the respondents articulated their interest in hiring humanities majors, and approximately 10% stated they would bring on social sciences majors (Adams, 2015).

Figure 1.1 showed the breakdown of employers' preference in hiring. Aggregated into 12 disciplines, the deciding major played a more significant impact on potential job positions sought after and filled. It also pointed out the importance of choosing majors that potentially prove lucrative and its potential influence.

Figure 1.1

Hiring Expectations

Academic Discipline	Number of Respondents Hiring Discipline	Percent of Total Respondents Hiring Discipline	Average Percent of Total New Recruits Within Discipline
Engineering	111	72.1%	56.6%
Business	105	68.2%	26.9%
Computer Sciences	89	57.8%	23.2%
Accounting	78	50.6%	18.1%
Misc. Majors	48	31.2%	19.5%
Economics	45	29.2%	10.2%
Physical Sciences	36	23.4%	14.1%
Communications	27	17.5%	11.3%
Humanities	17	11.0%	7.2%
Social Sciences	16	10.4%	6.4%
Agriculture	13	8.4%	6.8%
Education	8	5.2%	32.8%
Health Sciences	5	3.2%	8.0%

Note. Employers' Hiring Expectations by Majors (Adams, 2015)

Despite our historical leadership, fewer students had been pursuing these disciplines, attributing to the rank of 27th worldwide in producing STEM college graduates (Morrell & Parker, 2013). As reported by the US Department of Education, about 16% of high school students are attracted to a STEM career (Hom, 2014). How many of these students are women and students of color? How many are from other marginalized communities (Latinx, Native American, disabled communities)? And of those students, how many of them are Black students? The Economic Policy Institute stated 19 percent of black households have zero or negative net worth; only nine percent of White families are poor (Lee, 2019). Bachelor's degree holders in some majors net more than those with a specific graduate degree (See Figure 1.1). These advantages were keenly beneficial for Blacks. There was a gap between the highest-paid majors, STEM fields, and lowest-earning majors, early childhood education, human services, and community organization, as well as the people who guided them to choose these majors

(Carnevale et al., 2015). Blacks were at a greater risk of financing, failing to choose a major that does not produce residual wealth. This notion led to the question, “what is the narrative share with Black students?”

According to the Center of Education and the Workforce (2015), earning a Bachelor of Science degree in STEM majors (for example, engineering or architecture) potentially produced about 50 % more than those who choose a degree in sociology or psychology. It documented that Blacks tend to choose the latter majors (University of Kansas, 2015). Such underrepresentation in these careers was in stark contrast to the overrepresentation in community-based, the arts or human services majors who do not nearly pay for the years of training put into these fields (National Research Council, 2011). These decisions proved to dramatically alter the trajectory of Black families and other people of color (POC) lives. Many families were not privy to concept group economics and its power to help communities (Kochhar & Fry, 2014; Love, 2015; Richardson, 2007; Weller, 2015). According to William A. Darity, a professor of public policy and African American Studies at Duke University, “the origins of the racial wealth gap start with the failure to provide the formerly enslaved with the land grants of 40 acres” (Lee, 2019, p.3). Therefore, any fiscal advancement made by Black people threatened the status quo. As seen in Wilmington, North Carolina, it needed to be purged or eliminated, known the Wilmington Massacre or Wilmington Insurrection on November 10, 1898, and in Levy County, Florida, the Rosewood Massacre happened in January of 1923 (Glenza, 2016; LaFrance & Newkirk, 2017).

Another notable example of where persons worked hard to make a difference and they were met with violence is the burning down of Black Wall Street in the Greenwood neighborhood of Tulsa, Oklahoma, due to rioting from a neighboring town (History.com Editors, 2018). Bombed, burnt homes and businesses covering an area of 35 city blocks resulted. Racial

violence was an effective strategy to reduce the gains made during Reconstruction (Faust, 2020; Lee, 2019). In the last 50 years, various entertainment forms, like professional sports, have been the chosen path to acquire wealth for Blacks. The exceptionality of Michael Jordan, Lebron James, Chris Rock, or Beyoncé were anomalies. Black students were not aware that pursuing a STEM degree is much more attainable than the entertainment structure. A competent workforce and the growing number of STEM workers desired over the next decade grew to one million (Lazio & Ford Jr., 2019). Therefore, discovered innovative ways to get the next generation of students enthusiastic and passionate about studying science and math morphed into a national urgency. Students who mainly pursued STEM jobs are currently White, non-Latinos (Funk & Parker, 2018). What were the challenges students of color face when accessing a STEM major? Since 2015, the demand for STEM occupations remains steady. This study intended to explore why Black participation in STEM is low. It also included less opportunity than their White counterparts to earn higher incomes.

Statement of the Problem

Black students were not choosing STEM majors in college and therefore were not moving into STEM careers. Black students lacked encouragement from parents and teachers to pursue STEM opportunities (Alonso, 2019). This notion was problematic because it may not consider the myriad of factors Black parents encounter. Could the lack of encouragement to engage in STEM jobs stem from a lack of awareness? Non engagement from an early age had detrimental repercussions and places Black students at a disadvantage (American Psychological Association 2012). It led to Black students ceasing to believe in their ability to succeed, partook in STEM activities, and not seen themselves as a part of the STEM community. Each discouraging thought alone potentially halted the pursuit of STEM participation and intensified

when combined with other hindrances. A lack of role models was another disadvantage because the absence of role models discouraged students from going into a field where they feel like they do not belong (National Academies of Sciences, Engineering, and Medicine, 2018; Qian, 2015; National Academy of Engineering and National Research Council, 2014). This experience was what makes it more likely to quit when coursework becomes challenging. It led many Black students to lose confidence in their pursuits to STEM, likely because of unfamiliar curricula and values, which goes against how Blacks interact and learn (Figueroa et al., 2015). If Black students continued not to choose STEM as a major, it potentially affected the amount Black STEM employees present in the field and increase the challenge Black employees face with less representation. It also included less opportunity than their White counterparts to earn higher incomes.

Purpose of the Study

The purpose of this study was to discover why there is a disproportionate number of Blacks in STEM classes, investigated the possible contributing factors and analyze how the perception of STEM by Black students impacts participation in STEM courses at the secondary level. The purpose of this mixed methods study was to discover the central phenomenon for why Black students do not choose STEM classes in high school and do not select STEM majors for college.

Research Questions

The research questions addressed in this study were:

1. Why are Black students underrepresented in high school STEM classes?
2. What are the barriers inhibiting Blacks from enrolling in STEM courses?
3. Why do Black students opt not to declare as a STEM major when applying to college?

Theoretical Framework

This investigation used multiple frameworks. The leading theory presented by John Stacey Adams in 1963 addressed the concept that fairness and equity are key parts of a motivated individual (McKown, 2013). The idea that people were encouraged by fairness is equity theory. As a construct, equity sensitivity pointed to three kinds of individual inclinations for equity: (1) caring people prefer their input: output ratios be less compared to others, (2) equity sensitive people prefer their input: output ratios are equal to others in comparison, and (3) entitled people to favor their input: output ratios be higher compared to others. If they find an imbalance in work output or work effort between themselves and their reference group, they will modify their attempt to meet their supposed work share. Adams indicated that the higher an individual's observation of equity, the more encouraged and optimistic they will be and vice versa. If someone perceived an unfair environment, they were discouraged and eventually upset. Used often in the workplace, business leaders and managers have inquired about understanding the theories of motivation and then test them to expand their workforce's production and effectiveness. How equity theory was used and seen in education is similar.

The impact on students was the simplest way to recognize equity theory in education. When circumstances or access to content, curriculum, or opportunity were inequitable, a lack of motivation can result. Likewise, in business, an imbalanced work environment's perception affected workers where demotivation causes an imbalanced work environment (Huseman et al., 1987).

The motivation behind people's choices without external influence and interference is self-determination theory (Niemiec & Ryan, 2009). It was a method that looks at people's openness to move towards growth, development, and mastery. These people with life challenges

integrated new skills into a reasonable and organized identity (Ryan & Deci, 2000). The three focused categories measured include autonomy, competence, and relatedness (to the teacher and classmates). Although advancement was possible, it is not an automatic phenomenon and was, therefore, susceptible to negative influence. How many Black students interacted in a STEM class could provide insights into their participation rate and how they related to STEM.

Grit theory tests students' tenacity and predicted achievement (Anderson & Francisco, 2019; Perkins-Gough, 2013). According to Daniel Coyle (2012), "GRIT is that mix of passion, perseverance, and self-discipline that keeps us moving forward despite obstacles" (p.109). Colvin maintained that purposeful, disciplined, and steadfast habits are the means to achieve real mastery (Colvin, 2008; Coyle, 2012). Since grit was a trait and a skill, this research looked for possible patterns of those students applying and cultivating this praxis over time despite barriers. Perhaps it pointed to why some students intensify their efforts while others choose to give up. Used by schools and large organizations to support their constituents, the Grit Scale analyzes long-term resolution (Duckworth et al., 2007). It also was a critical indicator of long-term success and achievement.

These three theories, equity sensitivity, self-determination, and grit, supported this research study's theoretical framework. These three was the foundation of this research.

Significance of the Study

The reemergence of Black resiliency in STEM required increasing interest, connection to a job or career, and teaching differently to reach this population. Therefore, hooked students' interest in STEM was a factor which needs defining and transforming views of STEM, Another factor was building a clear career choice that upgrades and impacted a family's socioeconomic status. Student perception was shaped by parental input regarding job prospects

and success (Barge & Loges, 2003; Duncan & Magnuson, 2005).

Therefore, how STEM was seen and supported dictated the student's receptivity in school.

As a teacher working in urban schools throughout her career, I watched as the Black representation decreased in STEM electives, especially in the Advanced Placement science classes. As a Black science teacher, often the only Black person in the classroom. Students removed themselves from these courses and therefore cut their opportunity to capitalize on the wealth of interaction working within this social network: possible paid and unpaid internships, mentorships, and apprenticeships lost because of missed connections and taking chances. Black students' absence in these STEM classes excluded them from these networking opportunities. The lack of recruiting, supportive networking, and advocating for Blacks seemed to be missing in the high schools. Therefore, the scarcity of Black students in STEM classes and failure to foster STEM enrollment with this subgroup sent a tacit message to these stakeholders and their parents that their presence in school is for attendance purposes. The investment needed to increase Blacks as part of the STEM student population or academic elite, not a priority or necessary. This inaction weakened the relationship and trust between Black parents and school institutions. The researcher watched creative students lose interest in STEM classes instead of expanding their curiosity. The results were far more consequential than the number of class requests for STEM electives, but the drive that once existed with this subgroup decreases. Ingenuity wanes. Another consequence was apathy, which set in, and a "just enough" or "just get by" attitude succeeds—only seen in required low division science classes, Black students supported each other in excelling drops dramatically (Tisch, 2014).

The following unintended result was the vacuum created. The researcher's perception

that school attention and value seem to arise a few times a year when every student counts for teacher and administrative positions, the push for required test attendance observed in all subgroups, added to a checklist and during schoolwide data analysis with faculty. In short when accountability was present, so was school attention to all students, including Blacks.

Definition of Terms

American Dream: the ideal by which equality of opportunity is available to any American, allowing the highest aspirations and goals to be achieved (Oxford Learner's Dictionary, 2020).

Black diaspora: The composition of "people of African origin living outside of the continent, irrespective of their citizenship and nationality, and who are willing to contribute to the development of the continent and the building of the African Union" or the movement of Africans and their descendants to various parts of the world (DePaul University, 2019).

Brain drain: The loss or departure of educated, highly skilled or professional people from one country, economic sector, or field for another usually for better pay or living conditions (Cambridge Dictionary, 2016).

Implicit bias: The unconscious beliefs or labels that affect our awareness, actions, and judgements. Stimulated unwillingly, without knowledge or deliberate choice. Can be positive or negative. various levels of susceptibility (Kirwan Institute, 2021).

Positive feedback loop: Feedback that tends to magnify a process or increase its output (Positive feedback loop, 2020).

Race: A powerful social context, not biological but impacted by social meaning. It can be fluid entity (Onwuachi-Willig, 2016).

Racism: A belief that race is the primary determinant of human traits and capacities and

that racial differences produce an inherent superiority of a particular race (Racism, 2020).

School culture: Refers to the way teachers and other staff members work together and the set of beliefs, values, and assumptions they share, as known as the "attitude" (ASCD, 2020).

Shepherding: The act of guiding and protecting a group (Shepherd, 2021).

STEM: Science, technology, engineering and mathematics (Department of Homeland Security, 2011).

Wealth: The difference between the value of a family's assets (such as financial assets as well as home, car, and businesses) and debts. It is also known as your net worth (Folger, 2021).

Western science: An academic institution emerged from a European philosophical tradition, and until the advent of the 20th century was the almost sole domain of White males in powerful positions in first world countries. Within' refers to the positioning of these groups within first world countries (Hammond, & Brandt, 2004).

Limitations

This study had the following limitations:

1. The participants came from one school versus multiple school sites.
2. Participants came from multiple grade level classes like electives due to the time of the data collection.
3. This study took a broad view of Black students in grades 11 and 12. It did not necessarily focus on one gender. Perhaps other studies will go into more specificity for other factors not explored.
4. This study was impacted the COVID-19 global pandemic.

Assumptions

There were numerous assumptions made by the researcher:

1. The researcher assumed that the participants were interested in one of the STEM disciplines at one point in their schooling.
2. The researcher thought more Black students were interested in STEM but not recruited or encouraged at a crucial time.
3. The possible barriers inhibited Black students are not only similar but multifaceted.
4. There was a lack of support from parents, so that the disinterest may stem from home.
5. The students were not interested in STEM.
6. Something or context missing in the curriculum had Black students not motivated to follow through in selecting STEM as a career choice.

Lastly, STEM was the pathway to economic prosperity in Black families.

Delimitations

The researcher was curious about the absence of Black students in STEM courses for the past few years at a particular school site. The number of minority students in the STEM honors courses fed into the advanced placement courses decreased and appeared skewed towards one population. Though this school site had healthy percentages among the various subgroups making up the school demographics, surveying the entire school population is the researcher's scope of the examination.

The research sampled participants who have been in the school a sufficient amount of time, articulating what led them to their choice of post-secondary majors and formulate a viewpoint on how this school site is fulfilling their promises. The study was the inclusion of only 11th and 12th-grade participants and the exclusion of underclassmen. Specifically, interviewed

Black 11th and 12th-grade students (population of interest) will help get to the research questions' answer.

Summary

Black high school students' insights regarding potential obstacles to taking elective STEM courses and pursuing STEM majors was the primary focus of this study. A secondary purpose was to alert teachers and administrators to the possible disinterest, creating a lack of representation in these courses and possible unintended results, created a feedback loop. Such feedback signaled Black students not to enroll because of the low number of Black students present in these classes. This loop perpetuated until there were no Blacks students, then it continued to signal not to enroll in the ranks. A tertiary purpose was to encourage meaningful discussions that fuel purposeful initiatives to increase Black students' involvement in STEM courses and activities. The purpose of this study was to discover why there is a disproportionate number of Blacks in STEM classes, investigated the possible contributing factors and analyzed how the perception of STEM by Black students impacts participation in STEM courses at the secondary level.

Due to the limited research regarding this issue, using the phenomenological theory study allowed the investigator to focus on the research's evolution. However, there was some literature and some theories touched upon an aspect of STEM motivation. None had pulled together in a cohesive study. The researcher attempted to take on investigating this issue. This practice also included combining theories and methodologies and relating sets of information based on the collected data from the subjects to produce a framework that had the practical application on why Blacks are experiencing this phenomenon.

Chapter 1 looked at the necessity of increasing the workforce to keep the US leadership

in STEM. Highlighted the dichotomy of the benefits of having a STEM degree and the increasing disinterests in obtaining one. It underscored the current gap of Black representation in these fields, its impact on families, schools, and Black student demotivation. It concluded with the research questions, a list of terms, and limitations attempting to tackle this issue. Chapter 2 is a broad examination of the literature beginning with (the shortage of individuals working in STEM careers and barriers inhibiting their engagement. Further research could include expanding the number of schools studied. It showed an isolated issue for this school site or a systemic problem worth addressing.

CHAPTER 2: REVIEW OF LITERATURE

Introduction

This literature review addressed Black men and women in STEM, the disenchantment of the American Dream, and STEM participation's economic impact. It examined STEM student enrollment/retention related to school campuses' racial climate, racial inequities, and student engagement. Across this country, the Black student subgroup had a point of interest regarding how to increase their performance. The various modes of engaging this issue had not been investigated using the Black student voice. This review attempted to uncover the possible barriers, both past & present, preventing Blacks from progressing in STEM. The multiple-framework lens used to approach the research allowed the investigator to examine the overlapping and complex issues that may arise. Scholars, activists, and leaders interested in tackling STEM education disparities will benefit from the research. It revealed the hurdles Blacks experience and informs others how to support their advancement effectively.

American Dream

Although the United States has historically been a STEM leader, 28% of first-year high school students declare their intention in a STEM-related area. However, 57% of them will lose interest as they approach high school graduation (Hom, 2014). The downturn of interest in STEM impacts the next generation, extinguishing budding life goals and dreams before it has a chance to grow. Black students are underrepresented in STEM, and their participation is lower than their majority counterparts (Carpi et al., 2017).

It also appears attaining the "American dream" was more of a fantasy to the average Black person due to our society's educational inequalities and economic disparity (DeSilver, 2013; Hanauer, 2019). Policies like "zero-tolerance" marginalized students of color by inflating

school procedures' minor violations into criminal acts (Graham, 2015). With the increase of police presence, small incidents escalated and snowball quickly. For example, in October 2015, a teacher requested police assistance with a student using a cell phone, not school policy. Other students in the class captured what transpired next by video. After the student refused to leave the classroom, the police officer violently grabbed the student by the neck, flipped the student and her desk to the floor, forcibly dragged her across the class, and then arrested her (Brown, 2015; Nance, 2016). School and community stakeholders once disputed these infractions within schools' walls are disproportionately affecting the most vulnerable students.

Such push out trends created the application of extraordinary disciplinary measures more onto Blacks than Whites. The comparison statistics were 51 % to 16 % enrollment of White students to Black students to the public schools' multiple suspension rates are 31 % to 42 %, respectively (*School-to-Prison Pipeline [Infographic]*, 2019). Criminalizing Black students had become commonplace, but U.S. classrooms inconsistently shared information and facts regarding Black role models beyond Martin Luther King Jr, Fredrick Douglass, and Black STEM contributors outside George Washington Carver. Often their contributions were discoveries during February's Black history month. Black contributions remained a surprise and hidden from public knowledge (Sondern, 2019). It seemed the influence of Black scientists was omitted in schools because it may run counter to the current narrative regarding students of color and deemed not essential (D. E. Collins, 2018; Waxman, 2020).

According to Seggar and Wheeler (1973), African Americans were often portrayed as traditionally blue-collar workers. In 1988, the media portrayal did not change. Researchers (as cited in Punyanunt-Carter, 2008) found Blacks continued to be represented as service worker jobs like a servant, custodian or maid, all forms of entertainer, depressed, athletic, or criminal.

Public perception made a difference; student expectations and actions reflect it. The contemporary discourse had it that Black students are not high achievers or unable to understand abstract material. They, therefore, were not capable of excelling in upper-division math and science courses. It was no wonder why Black students are neither directed, not encouraged, nor counseled to take STEM courses, let alone becoming STEM majors. The reassessment of possible dynamics impacted their membership in STEM is needed to shift into positive outcomes (Estrada et al., 2016). This analysis included Black student engagement, Black economics, student enrollment and retention in STEM, the school campus's racial climate, related institutional procedures, racial inequities in academic counseling, the effect of school initiatives, various biases, and the barriers present in STEM careers. Moreover, this examination explored equity theory (ET), self-determination theory (SDT), and grit theory (GT) as lenses to understand the literature. The researcher discussed each of these subtopics below.

STEM impacting Black Economics

Researchers suggested that parental socioeconomic status (SES) directly influences a child's subsequent job fulfillment and is a compelling and dependable predictor of career fruition and achievement (Duncan & Magnuson, 2005; Hill et al., 2004). Though Black families were not a monolith, according to Forbes, over the past 30 years, Black wealth at the median never amounted to more than about one-fifth of White wealth (Weller, 2019).

The unequal distribution of wealth was the basis for the vicious cycle that Black families endure increasing economic instability (McIntosh et al., 2020; Oshinsky, 2017). It was codified in government policy and law (Rothstein, 2017). Government policy and law codified in perpetuating this pattern (Choudhury, 2001; Smeeding, 2016). Like increasing Black students' education levels, a decisive factor had not combatted their families receiving a proportion of

wealth, their White counterparts experience. Fewer opportunities for mobility created fewer chances to build and pass on wealth leaving Black students more economically insecure (Hanks et al., 2018; Weller, 2015). The next generations lacked the benefits of capitalizing on crucial drivers that set up families for success.

Such drivers include homeownership, tax benefits from homeownership, and living in communities with high property values attracted selective affluent people (Rothstein, 2017). This cycle creates small networks to circulate the wealth and keep out others. Consistent labor force discrimination and segregation limited Blacks into fewer and less promising job position opportunities than White equivalents (Hanks et al., 2018).

The U.S. Department of Commerce, Economics, and Statistics Administration noted that STEM workers were less likely to experience joblessness than non-STEM workers. STEM workers drive innovation and increase competition in the U.S. (Chan, 2013). According to Langdon (2011), if the U.S. STEM employment projected to grow from 2008 to 2018, how does it help the U. S. economy keep the wealth from circulating into areas that need it the most?

Black Employment in STEM

Black STEM graduates. The prepared Black person with proper credentials cannot compete with their Latinx and Asian counterparts, according to the 2013 Census Bureau, where Blacks continue to rank low in job prospects or hiring (Landivar, 2013). Current STEM occupation breakdown had over 40% Asian, 18% are Latinx, and about 17% were Black. Blacks working full time and year-round in STEM occupations earned less than their Asian and Latinx counterparts (Funk & Parker, 2018). The Black subgroup landed at the end of the salary scale analysis. The STEM wage gap between races in the U.S. is apparent based on the median salaries. The current U.S. median wage for working Blacks in STEM jobs was $75,000 and

approximately $77,000 for Hispanics, whereas Whites earning slightly more than $88,000 annually (Ouimet, 2015). The equity had not reached the STEM professions, and multiple researchers alluded to employers not granting Blacks similar compensation as their counterparts (National Science Board, 2018; Joseph, 2018; Perry, 2018). Even with initiatives created to increase Blacks in the STEM fields, they were met with hiring practices that questions their education, STEM training and competency (Simon, 2016).

The impact on their families and communities created a negative feedback loop. Entertainers and athletes are held as role models because they chose a path that resulted in greatness from poverty. There was no reason for parents to encourage their children to pursue such careers if they do not receive adequate pay as their counterparts or as seen in the other fields like entertainment or sports (Joseph, 2018; Qian, 2015). If young people could see themselves achieving what they perceive as the ideal career path, there is reason to pursue it. This message of the pursuit of the American Dream had echoed throughout their lives. It was also a reminder of what should be possible in the U.S. The activities requiring the utilization of more physical ability than mental had been promoted not only but also reliably compensated many parties for centuries. As a result, the notion of hard work was neither a problem nor a negative.

Therefore, one's physicality was the best way to succeed, and frequently this idea was nurtured by multiple fronts; media, school institutions, and films, to name a few. It continued because of the lack of other Black professionals promoted to counteract and show options. Black professionals making an impact are unseen (Brown, 2020; Gladden-Young, 2020). Therefore, it kept the status quo in place with a low percentage of Black participation and presence. Black learners were left and fending for themselves, operating with little to no network (Charlton, 2019; Funk & Parker, 2018; Goff et al., 2014; Johnson, 2019; Wingfield, 2015). Georgetown

center's chief economist Nicole Smith (as cited in Escobar, 2016) suggested that students considering a STEM degree may drop out of demanding course work if they feel unfit in a predominantly White program. However, to meet the demand and compete with other countries, harnessing the same group's talents that comprise a big part of the students projected to attend U.S. universities in the next 30 years proved crucial. It would be beneficial for this country to reap the investment placed in taxpayers' public education.

Economic Impact

The stream of African Americans from the rural South to the cities showed the relation between Black migration and the current population distribution. Before the 1860s, states with large Black settlements remained the same with a high concentration of African Americans. This pattern alluded to a persistent problem that had lasting effects. Professor Sean F. Reardon, one of the nation's leading experts on residential and educational segregation (as cited by Boschma & Brownstein, 2016), noted that "It's the measure of segregation that is most strongly correlated to the racial achievement gap. The difference in the rate at which Black, Hispanic, and White students go to school with poor classmates was the best predictor of the racial-achievement gap" (p.2). The lack of deliberation on promoting economic progress in these communities keeps them socially and economically immobile. This cause trickled down to educating the populace.

Researchers maintained those who acquire a college education are more apt to increase their capacity to achieve social and financial flexibility than those without a college education (Lin & Vogt, 1996). The average incomes of an adult's working lifetime vary depending on the amount of knowledge obtained. Day and Newburger (2002) contended that, on average, a high school graduate earns $1.2 million, an associate degree graduate earns $1.6 million, and those with a bachelor's degree receive $2.1 million. Students chose to attend graduate school to earn a

master's, doctorate, or a professional degree could potentially make close to $2.5 million, $3.4 million, and 4.5 million respectively, according to a record issued by the United States Census Bureau in 2002 (Day & Newburger, 2002).

Black Americans' trend increased in college enrollment; however, the number of bachelor's degrees awarded declined by .3% from the three years of tracking (Musu-Gillette et al., 2016). A study by the Status and Trends in Blacks' education showed a two percent gain in undergraduate enrollment from 1980-2000. Out of all bachelor's degrees awarded, Black Americans held 9%. As for master's, 8% while 7% to professional degrees and 5% of doctoral degrees (Hoffman & Llagas, 2003). Supported by U.S. News/Raytheon STEM Index, STEM bachelor's degrees rose 60 % from 2000-2014; however, this data comprised a slice of the overall number of bachelor's degrees Black students earned during that time (Escobar, 2016). A broader time range is needed to be considered to observe some improvement. Any progress made had been minimal; however, the value of having a lucrative degree makes a difference.

Choosing a STEM field impacted the economic welfare of families (Joseph, 2018). The economic value of graduating as a STEM major proves higher than majoring in a social, community-based major. Center on Education and Workforce at Georgetown University stated that Black earnings increase by 50% in STEM majors, especially in architecture and engineering (2015). It propelled the family to a higher socioeconomic status, which allows the Black families to afford opportunities that were not formerly provided. Often Black students are pushed to choose humanities fields, which had yielded a net loss (Carnevale et al., 2015; Grissom & Redding, 2016; Joseph, 2018). Many Black families were unable to break through the economic divide and succumb to the vicious cycle of debt (Drash, 2016). Professions in the humanities or community center were a part of the lowest median earnings for Black people, according to the

Georgetown study. It had been a bit of a comfortable ceiling for this subgroup, where Black students attain bachelor's degrees and bring pride to their families. The reality was that they are not making enough money to move their families to the next income bracket to make a difference economically (Carnevale et al., 2015).

Becoming a STEM Major

After a Black STEM major earned a terminal degree like a doctorate, how do their colleagues see them? As stated in the New York Times, Black Americans receive about seven percent of the doctoral degrees granted each year across all disciplines, but they have earned just one percent of those given over the last decade in mathematics (Harmon, 2019; McGeehan, 2012). This small pool of talent was either leaving STEM or guided to other disciplines at the onset of their school career, which is further evidence of a broken US STEM education pipeline. Therefore, the remaining number of Black employees presented in the workforce cannot make the impact needed to transform the perception of Blacks. The enduring racial inconsistencies within the multiple levels of STEM education need amending. The STEM community must welcome fresh ideas and new skills from the next generation to tackle unsolvable problems. There were struggles uniquely concerning Blacks often overlooked, and it will take Blacks pushing the concerns (Charlton, 2019). They needed to be a part of the decision-making process to bring Black interests and apprehensions to the forefront (Killpack & Melón, 2016).

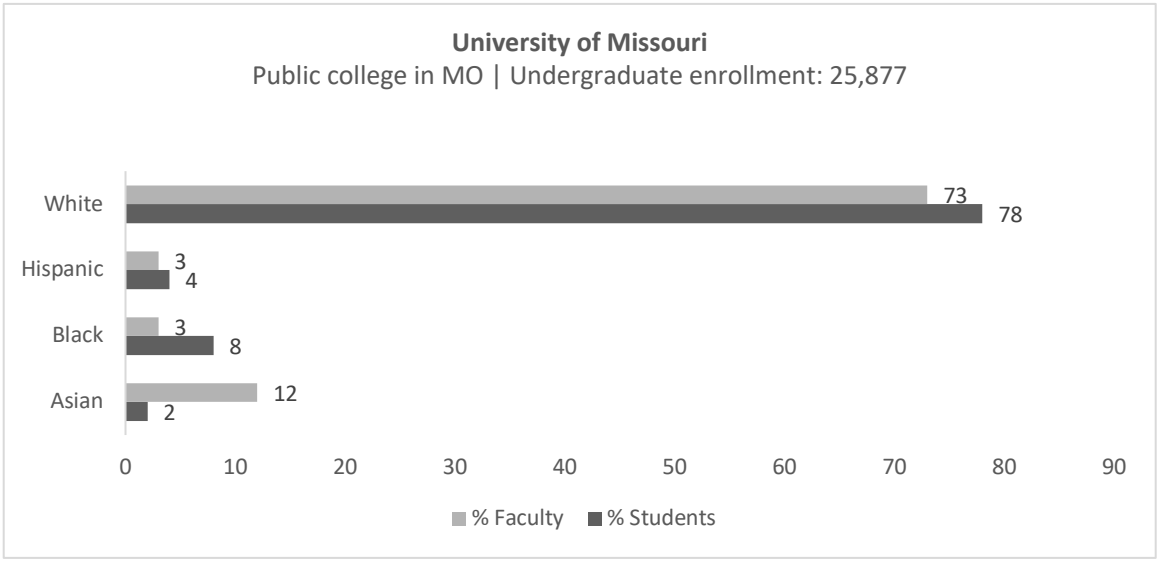
At the college/university level, an internal equity report spoke to Black scholars' perception in the academic setting (Columbia News, 2018; Colombia University Policy and Planning Committee, 2018). This coverage found a need for diversity in the senior ranks of academic departments and centers in the undergraduate program at Columbia College and the School of General Studies and Graduate School. The self-reflected surveys taken by the faculty

surfaced opaque policies such as hiring practices, lack of transparency regarding decision making, and its importance on keeping these dogmas in place, as well as salary among women, along with underrepresented minorities and the chronic issue of harassment and discrimination despite assurances (Columbia University Policy and Planning Committee, 2018). Annually, Black faculty hired fell from 7 % to 6.6 % from 2006-2016, though predominantly White institutions (PWIs) have pledged to increase diversity within the instructional staff. In 2016, the tenure track statistics for Black faculty were as follows; 3.5 % at University of Missouri, 3.5 % at Yale University, 2.2 % at Dartmouth, and 1.5 % at Claremont McKenna College, despite the promise of investing funds in diversifying the faculty (Krupnick, 2018). Furthermore, Blacks make-up approximately 12 % of undergraduate and graduate attendance (Krupnick, 2018).

Figure 2.1 depicted the small percentage of Black faculty and students present at the University of Missouri. It supported claims of a lack of diversity in both faculty and student body. It also shows a lack of urgency to change if a small group is impacted (Flannery, 2015). This inaction generated an unwelcome and exclusive environment while simultaneously keeping out different perspectives in solving elusive problems troubling the STEM field.

Figure 2.1

Fall College Enrollment



Note. Fall Undergraduate Enrollment and Full-Time Instructional Faculty in 2016 (Krupnick, 2018)

The creativity and innovation drained from the STEM field as fewer people pursue these professions tend to turn off potential newcomers to bring multifaceted solutions (Malcom et al., 2016). The "brain drain," the migration of educated and talented people exiting persists, in these corresponding fields (Charlton, 2019). The U.S. lost its advantage of harnessing the best of the best from its citizenry.

In 2010, most American research departments shared apprehension on their inability to recruit and retain underrepresented undergraduate populations (Johnson & Okoro, 2017). These STEM department chairs recruited from a pool of students where Black males make up 6% of science and engineering degrees. In 2013, women constituted 7% of all STEM degrees received, as reported by NSF.

Although 84% of 413 STEM department chairs from leading research universities boasted concerns about recruiting and retaining underrepresented undergraduate populations in 2010, only about 33% of those acknowledged that they had a diversity plan for STEM talent development (K. H. Collins, 2018). The need to increase minority representation in STEM continued to be a primary concern for researchers, educators, employers, and government agencies (Agrawal et al., 2016; National Science Foundation, 2018).

Data also demonstrated the disparity between subgroups of both gender and race. As said by the National Science Foundation, in 2012, White women earned 6,777 Ph.Ds. in STEM fields, while White men earned 8,478 Ph.D. degrees. That number lessened to 684—10 times fewer scientific doctorates than their White counterparts for Black women. "For many African-Americans, particularly women, there's an interest in careers that are intellectual or care-giving in nature"(p.4), Harvard University sophomore Solange Azor (as cited in Escobar, 2016) suggested. "Some people are motivated by knowing that they touched someone's life in some way," (Escobar, 2016, p.4). As overall degree holders increased, the more substantial cluster continues to consist of social sciences, dominated by Blacks.

The impact of not promoting and sustaining Black contribution slowed down overall progress. The depletion of technical personnel kept unsolvable issues unsolved and delay advancement while perpetuating false narratives of Blacks' inability to thrive in STEM (Funk & Parker, 2018). Keeping their contributions hidden also held the next generation from succeeding and propagates an underclass. Their intellectual inheritance cannot be used to leverage a better society (Trawalter et al., 2008). Regression ensues, and psychological threats endanger to stifle any possible glimmer of progress.

Stereotype Threat Condition

Test scores track achievement (Boudreau, 2019). It is a factor used to discuss student achievement. High-stakes testing gave various entities a snapshot of how students are progressing, what standards to create, how to use benchmarks as a measuring tool in supporting measures put in place (Hamilton et al., 2002). It provided insight regarding candidate selection, who, and what attributes to further the educational agenda or institution's mission. This plan led to the question: are the standardized testing students subjected to evaluate them equitably honestly?

Researchers Steele, Aronson, and Spencer (1995) found that the assumptions ascribed to girls and Black students regarding their testing abilities and academic performances are inaccurate. Negative stereotyping created and increased thoughts of uncertainty and anxiety. This phenomenon, coined as "stereotype threat," impeded their ability to perform effectively (Berwick, 2019; Burgess et al., 2012). Stereotype threat was not something that materializes solely on standardized exams. It had massive implications and applied to other instances and areas. Its relevance constituted how pressure impacts behavior — the first parameter tests for highly motivated Black and White college students (Jencks & Phillips, 1998). The second lasted 30 minutes using challenging items from the verbal Graduate Record Exam (GRE). And the third was two group batches, stereotype, and non-stereotype (Casad & Bryant, 2016). During the stereotype threat batch, the students informed, the test analyzed for intellectual ability, while other, non-stereotype threat batch, given the exact test with expressed as a lab task did not suggest ability. The Black students underperformed in the stereotype threat scenario even though they were initially equivalent to the White students in their group by SAT scores (Steele, 1999).

Conversely, in the non-stereotype scenario, Black students' performance rose to tie in with that of equally skilled White students (Casad & Bryant, 2016). Further experiments reduced the stereotype threat rife in standardized tests caused comparable performance. Another study discovered that when students recorded their race (seemingly making the stereotype noticeable) and were not informed that the test was indicative of their ability, Black students continued to perform less than Whites (Schmader et al., 2008).

In an interview with Dr. Claude Steele, he expressed the vicious cycle women faced and the possible reason why there are so few numbers in STEM.

> As I say, we've looked at the same kind of thing regarding women and mathematics. For that group, it is particularly rife with a stereotype as they get into advanced mathematics work in college. Then, fewer, and fewer women are present. The world of mathematics and science becomes a more male world. Moreover, the threat of the sort we're describing here for women gets more intense (Steele, 1999).

It became difficult to overtake and deal with the preconceived notions regarding women in mathematics, so few are present. If they were present, they met condescending and covert slights that undermine their standing. The added layer of being a Black woman compounded in this environment, making it more challenging (Kramer, 2020). Such unwelcoming experiences did not make more Black women in particular, comfortable, or willed to enter fields that add more work and stress to a demanding area like STEM.

The article, Solving the Equation: Variables for Women's Success in Engineering and Computing, explored the idea of stereotype threat where the individual worries validated a negative stereotype regarding a group they fit (Corbett & Hill, 2015). In this case, it was the group "women," and the negative stereotypes include test anxieties, low mathematical abilities,

which added to disconnection or interests in computer and engineering fields. Such threats also impacted academic performance and perhaps performance in the workplace. The study also discussed the social relevance STEM fields have, and how it can be used or seen to pique female interests, how females see STEM as a vehicle to help others. See its ability created communities, took on a roadmap to break down concrete ways to turn women's downward trends in science and engineering. As an example, Harvey Mudd College made strides in increasing the graduation rate from 12 to almost 40 % in five years. While the rest of the country stayed at 11 %, Harvey Mudd also took the initiative to broaden engineering utility and created outreached opportunities that put women to work quickly and made it a welcoming environment for women to thrive. Workplaces with equitable management systems were more likely to retain female and Black employees because they provided distinct ways for progression in the organization (Lam, 2019). Harvey Mudd believed that stimulating but demanding assignments cultivates and promotes innovation. Thus, working in an environment where contributions were well-regarded and valued increases productivity. Some Black female STEM graduates figured out one way to survive in engineering programs is through partnership and support groups (Guy, 2020). However, this tactic did not transfer seamlessly in the workforce because it can be an isolating environment. For example, Stephanie De Ornellas, an engineer, worked in cybersecurity, where she experiences proving her worth with every project. De Ornellas stated that is a result of being a minority both in gender and race. Also, she was the sole Black woman on a 60-person team and one of five leads on the project. Experience had allowed her not to get intimidated by her male counterparts even if she encounters biases (De Ornellas, 2015).

Another related condition akin to stereotype threat was stereotype lift (Pennington et al., 2016). It involved the effect of racialized stereotypes on groups not typically marginalized, for

example, White males. According to Walton & Cohen (2003), the inappropriate comparison of the marginalized group like Blacks provided a performance aid to the other group allowing them to benefit and receive increased value or worth. Often coupled with an intellectual test, it seemed enough to cast doubt towards the marginalized group by increasing negative views while the non-marginalized group stance advances. Marx and Stapel (2006) took it a bit further and included the social self.

When the White male revealed his gender prior to test taking, it triggered the social self directly and has more impact than diagnostic of ability test itself (Marx & Stapel, 2006; Walton & Cohen, 2002). In other words, neither one of these manipulations alone sufficed to probably cause strong lift effects (Marx & Stapel, 2006). If both manipulations combined, however, then they may be strong enough to activate non–targets' social self and the associated positive group–based stereotype, thus leading to bigger stereotype lift effects (Marx & Stapel, 2006). It ultimately relied on the deficit thinking of the targeted group to fuel positive outcomes. It stimulated the associated condition called stereotype boost within person/group creating a positive affect for the non-targeted group (Schmader et al., 2008; Shih et al., 2012). This boost showed where Asian American students are either offered to be or placed in highly gifted and talented classes or advance placement classes to capitalize on advancement opportunities in their studies, therefore, setting them up for four-year college admissions. It transpired when a positive aspect of an individual's or a group's social identity is made prominent in an identity-relevant area like science, technology, engineering, and mathematics. For example, in New York City, Stuyvesant high school made it painfully salient by offering over 500 seats to Asian American students. They continued to be resistant to the option of dropping their entrance exam; this factor kept Blacks out (Shapiro, 2019).

Blind Conditions

Colorblindness

Weingarten suggested that White Americans widely believe that the U. S. is a colorblind society. In a 2014 survey by MTV, 70 % of millennials claimed that they do not see racial minority groups differently than White people (Weingarten, 2017). Not having meaningful and difficult conversations confronting such claims keeps a discourse in play that does not comply with or match the behaviors Blacks encounter in the workplace or from other various entities. The multiple video uploads of White Americans yelling at Blacks and immigrants for being or doing innocuous daily activities did not support millennials' assertions (Brancaccio & Nguyen, 2018). Instead, the current solution had one day, weekend mandatory workshops or training by small and large corporations mitigated inappropriate behaviors caught on video and a public denouncement by the corporation or person under fire (Sorkin, 2018).

The Intersection of Gender and Colorblindness

According to a group of Yale researchers, Americans socialized automatically group others according to three variables—race, gender, and age (Weingarten, 2017). That automatic grouping triggered stereotyping, meaning that "even when members seemingly included within a larger group or organization, they are vulnerable to subtle, often unconscious bias resulting from their membership in a lower-status social group" (Weingarten, 2017, p.4). Therefore, claiming gender and colorblindness became a cover to absolve micro-aggressive behavior. It also become problematic during the hiring process while evaluating potential candidates for a job position or offering a limited number of slots for the next incoming class (Quillian et al., 2017).

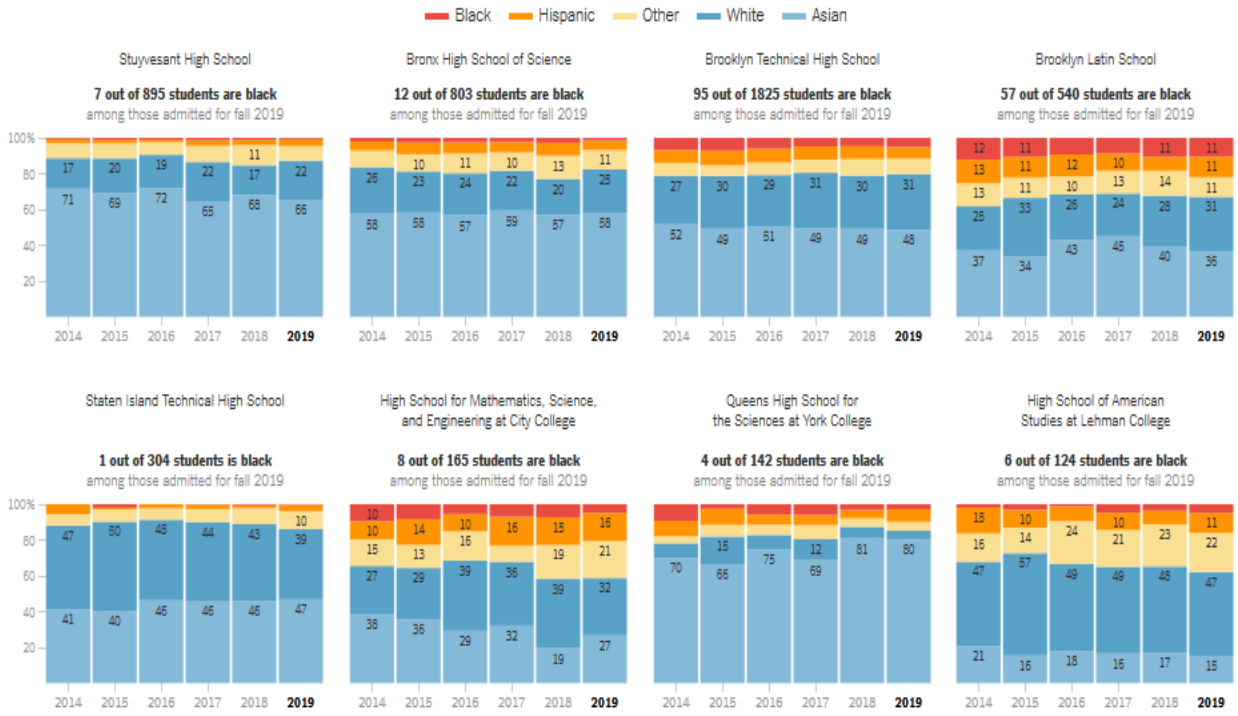
Writer Sarah Yost noted that several White educators say, "I treat all my kids the same." While this may come from a sincere place of wanting to promote equality, a colorblind

perspective can diminish and undermine a child's culture and identity and the validity of painful experiences they may have had with racism and bias (Yost, 2018, p.1).

New York Times writer Eliza Shapiro (2019) reported seven Blacks out of 895 slots offered to attend Stuyvesant High School, one of the highly regarded specialized high schools in New York City. However, the numbers had dwindled steadily over the decades, becoming striking with ten students offered in 2017 and 13 students provided in 2016. In another school, Bronx Science proposed 12 Black students, shrinking from 25 students extended the previous year (Shapiro, 2019). However, 74 % of the student body at Stuyvesant are Asian-American and received 587 offers to attend. White students received 194 seats and extended 33 seats to Latinx students, which increased from 27 from the previous year (see Figure 2.2).

Figure 2.2

NYC Specialized High School Admissions



Note. Admission offers by subgroups at NYC Specialized High Schools in 2019 (Shapiro, 2019)

Though New York Mayor DeBlasio proposed to level the field by overhauling the system, he received a great deal of push back from the Asian community. They argued that Asian students would lose half the number of seats offered under his proposal, and they did not understand why the concession of a new school to replace the lost seats was not considered (Shapiro, 2019). According to Shapiro, the statistics did not sway critics of DeBlasio's plan, and it was unlikely the New York State Legislature would be unwilling to look into the matter. What was not discussed was the steady loss of spots once occupied by Black students over decades while the numbers for Asian students increased and yearly conversations of the low enrollment of Black students with no concrete action plan to remedy or increase access (Harris, 2019).

Racial Microaggressions

Systemic racism persisted to be a significant problem that affects Black and brown people daily. How it perniciously displayed was through microaggressions. The research examined the forms of microaggressions Blacks face. This study looked at the interpreted connotations and their emotional effects on various microaggressions through a qualitative approach. The study sort to uncover the hidden messages associated with power and privilege (McIntosh, 2019). Making an impact required a concerted effort to identify the conscious and unconscious biases became commonplace but created an uncomfortable environment which hindered Black scholars' development (Agarwal, 2018).

According to Sue, Bucceri, Lin, Nadal, and Torino (2007),

> racial microaggressions are brief and normalized everyday lexical, behavioral and environmental indignities, whether intentional or unintentional, that communicate hostile, derogatory, or harmful racial contempt and insults to the targeted person or group, and are expressed in three forms: Microassaults, microinsults and microinvalidations (p. 72).

Microassaults were probably most like what has been conventional racism because their communication was deliberate, conscious, and explicit (Sue et al., 2009). These communications of racism were usually assumed by the microaggressor, whose purpose is to harm, harass, or victimize a person of color (Gaertner & Dovidio, 2000). Verbal, nonverbal, or environmental actions showed tactlessness, were disrespectful, or directly offended a person's racial identity or culture can be classified as microinsults (Carter, 2019). Microinvalidations were behaviors that deny, undermine, or damage the psychological thoughts, feelings, or experiences of people of color (Sue et al., 2009). The invisible nature of microaggressions is what continues to drive the power it possesses to afflict pain and cause hardship to Black people. These offenders do not necessarily intend to express hate like in microassaults because these biases and discriminatory actions reside outside of their perception. The need for discernment and courageous conversations about one's preferences and prejudices had not been brought to the forefront of people supporting Black students. For example, a White security guard or worker followed a Black customer or teenager around a store. Flippant comments like "You are a credit to your race" or "You are so articulate" to a Black person were examples of microinsults and a sign of unconscious ignorance (Thai & Barrett, 2007). Furthermore, complementing one's diction and asking the country of origin was an instance of microinvalidation.

Therefore, eradicating racial microaggressions by highlighting their existence and reduced their impact on attaining equal access created an opening in closing the achievement gap (Runyowa, 2015). It also brought to the forefront persistent concerns of vital importance for counselors who embrace a multicultural/social justice helping perspective (Sue et al., 2009). Furthermore, it provoked imposter syndrome, drawing out insecurity, unworthiness, and feelings of incompetence at that school site or workplace. Others experienced stereotype threat as the

debilitating fear of justifying a stereotype about people from your identity groups (Runyowa, 2015). It translated to a worsening feeling of inferiority and inability to absorb earned achievements or accolades (Collins, K. H., 2018; Douglass et al., 2016; Peteet et al., 2015).

Investigating the link between microaggressions and implicit biases and the different transmission forms tend to communicate the spread of discriminatory, large-scale influences. Implicit biases had adverse ramifications passed hurt feelings, from insidious employment approaches to racially discriminatory practices in lawmaking, enforcement, and the more extensive U.S. criminal-justice system (Schwartz, 2019). The first place where Blacks experience implicit biases was in the classroom. Therefore, underestimating its effect had a detrimental influence on various sectors of the economy, caused stagnant and declining schools and downshifting progress in different industry areas. Furthermore, it created the inability to staff STEM positions, lacking vision and resources to help ailing local economies to transition to new technologies, to name some (Harrison & Tanner, 2018; Novoa & Hamm, 2017).

Most critics used the notion of "political correctness" as a guise fixated on shutting out opposing or conservative ideas and often calling for the "good ole days." For whom was it good? To be subjected to racism is neither glamorous nor an opportunity to reap the benefits of being a casualty (Schwartz, 2019). Victims also mischaracterized as obsessive and radicals dramatizing innocuous conversations or remarks to scandalous forums because they choose to speak up (Carter, 2019). Those who profit from oppression were also the ones who benefit from their immunity. Rooted in empathy, not sympathy, building the capacity to experience another's emotions invited more in-depth conversations about alienation faced by minorities (Liu, 2020).

According to a new Rutgers University study, Black adolescents experienced racial discrimination numerous times daily and have concluded it is often leading to depression (Bailey

et al., 2019; English et al., 2020). These anti-Black microaggressions look like peers racial teasing/joking, forced as race ambassadors, or exposed to a social media racial post. Without intervention, it became debilitative because of its invisible properties. These experiences, like racial joking, led to short-term increases of anxiety indicator (Clay, 2017; Douglass et al., 2016). As anxiety builds, so does the inability to learn and retain information. Its effect was unseen until reaching a breaking point, and the typical response is befuddlement. Looking at various ways to recognized the power and control microaggressions have, especially on young people's minds, was more reason to identify factors and symptoms and examined the possible training level needed to remediate (Clay, 2017). Forward thinkers were required to take on how anxiety fluctuating hindered academic performance due to the bombardment of multiple racial discriminations in society. The principal purpose of underscoring the connection of microaggressions and implicit biases was to highlight its impact to bring about a culture of reasonableness and humanity into every social interaction. Ignoring its effects ran counter to educational institutions' goals of all levels (Crandall & Garcia, 2016; Sue et al., 2009). It started with learning institutions as possible demonstrative places of respectful interactions in action from kindergarten to university level with school communities' commitment. However, finding these agents of change or allies to help voice the voiceless were the next hurdles at work.

Implicit Biases in Counseling

The unique issues Black students faced while attending predominantly White institutions (PWI) included overt and covert campus racism, daily microaggressions, limited or no sense of belonging while attending (Lee, 2018). One of the places students turn to when they were experiencing such challenges is the academic counseling department (White, 2020). This office was the department tasked to support the students' educational plan and helped them navigate the

unfamiliar on campus. Such responsibility carried weight and influence. However, what options does a student have when the very office they look to for assistance is unwilling to acknowledge their experiences on campus? How practical was the support when racism influence is not considered in the affairs of Black students? Can academic counselors effectively advocated for this population of color, Black students, if they cannot affirm these students' daily struggles while maintaining an awareness of how racial pressure impacts the relationship with academic professionals? Dr. Cox noted “with implicit bias, it’s tasteless, odorless, to everybody except the victim” (Chuck, 2018). Students and parents relied on the school counselors to program the student coursework around possible interests. In particular, Black parents and students needed their guidance counselors to help navigate and encourage career goals. Therefore, recommending pipeline programs introduced students to STEM careers outside the classroom may impact future course selections and majors (Alvarado & Muniz, 2018). Lee (2018) presented research that describes the challenges that intensified when academic counseling is not present to microaggressions Blacks encounter daily and their own implicit biases. For example, without discussing academic records, Blacks directed to pursue less challenging coursework instead of assisting them with information regarding majoring in math or science majors like biology, physics, or calculus (Runyowa, 2015; Weingarten, 2017). Black students who had the opportunity to attend elite secondary schools like Stuyvesant High lamented that only one participated at the five-year reunion out of the small group of Black students in their class. The reason cited was not wanting to relive or celebrate their high school experience. The low population of Black and Latinx students, coupled with many social issues, made the school experience difficult (Harris, 2019). Post-secondary Black students reported more hostile and negative experiences on PWI than cultural minority groups (Feagin & Sikes, 1995).

Researchers Harper and Hurtado's (2012) meta-analysis found students of color across 31 campuses remained consistent. They expressed dissatisfaction and showed increased racial incidents reported to campus authorities from their previous study in 2007. The national survey had 4,037 students of color participating. Notably, Black students had higher reporting on racial incidents — the feeling of exclusion from events experienced by more than half of the Black students. Compounded by the regular experience of hateful and hostile racial comments was the sense of ostracism of activities in peer environments.

In Oberlin College, students of color categorized the incessant barrage of racial microaggressions both written and conversational across campus inflicted upon students and faculty on a website, Oberlin Microaggressions. They took action because dismissing their claims were frequent due to its liberal campus leanings (Runyowa, 2015; Students of the Afrikana Community, et al., 2013). Other websites exposed other PWIs because of their discriminatory actions. It connected and informed folks to how issues were handled or not on campus as anecdotal accounts as evidence for the need for reform (Students of the Afrikana Community, et al., 2013).

When Black students at PWI met with their academic counselors discussed such issues impacting their experience on campus, their responses were disbelief, insensitive and incredulous comments or told it is not as bad as they think. Instead of getting to productive ways to navigate the system, they did not feel included (Wallace & Bell, 1999). They were not giving support from the people who task to do so. A large percentage of Blacks targeted racial bias incidents among the overall incidents with about a third reported (Ross, 2018). The impact was the two-thirds not said adds to the continued silence, and the fable of racism is no longer a factor (Horowitz et al., 2019). Therefore, Blacks were on their own. What has emerged as a result were

pre-professional groups? They were explicitly seeking Black students like the National Society of Black Engineers (NSBE), culture clubs like Haitian American Student Association (HASA), Caribbean American Student Association (CASA), or Black Student Union (BSU). Their shared mission centers around creating habitats within the campus environment where Black students receive support and networking opportunities available to propel them to the next echelon of success.

Implicit Biases of Teachers

Implicit biases were the mindsets or stereotypes that affect our actions, comprehension of life events, and decisions in an unconscious manner (Grinberg, 2015). Without awareness or intentional control, involuntary triggered may advantage some people while disadvantaging other Kirwan Institute, 2021; Staats, 2016). "Social scientists believe that implicit biases are learned as young as age three and maybe fueled by stereotypes perpetuated in the media or other beliefs passed along by parents, peers, and other community members" (Flannery, 2018, p.1). There was no immunity. Susceptibility of one's implicit biases impacted all societal sectors. All is not lost once they are identified, they can be "unlearned"(Grinberg, 2015; Tyner, 2019). The nature of implicit bias is that the individual does not know if the individual has it.

According to Costello and Dillard (2019), rampant discrimination and biases created ongoing effects. As the Migration Policy Institute noted, "children who experience discrimination from their teachers are more likely to have negative attitudes about school and lower academic motivation and performance and are at increased risk of dropping out of high school" (p.4). These occurrences added to a toxic school culture where it is hard to pinpoint it then later uncover it is ubiquitous (Goff et al., 2014; Killpack & Melón, 2016; Manrique & Sánchez Abchi, 2015). Such discriminations shaped students' outlooks regarding their academic

progression such that they no longer feel a part of the school (Costello & Dillard, 2019; Gershenson et al., 2015; Odemwingie, 2018). They tended to disengage, convincing themselves that their courses are no longer valuable since the purpose of doing well may not be attainable, based on the feedback received from their teachers. Academic counselors were also cut back in the primary schools or not offered, which amplifies the disengagement. The impact was a cascading effect on other stakeholders.

Black students tended to garner low expectations from non-Black teachers resulting in unconsciously setting small targets and benchmarks (DeRuy, 2016; Goff et al., 2014). Not providing students with differentiation or appropriate scaffolding gradually reduced progress and kept complex material out of reach (Darling-Hammond et al., 2020). As teachers delivered non-grade level work or use below grade level text that is unchallenging, they get used to the non-rigorous effort and resist activities demanding and requiring critical thinking. Investigators pointed out that the systematic biases that impact student success are teachers' influence, making a profound impression on disadvantaged students (Anderson, 2017). Black learners' cognitive skills were untapped; therefore, such skills atrophy when subjected to consistent non-grade level work (Garcia, 2015). Researchers investigated teachers' methodology as they categorize preschoolers' behavior based on their predispositions, which adds to the gaps of their classroom management styles among White and Black learners (Garcia, 2015; Gilliam et al., 2016; Goff et al., 2014). In contrast, Asian-Americans, unrealistically seen as a monolith, are tagged as an academic archetype for marginalized subgroups. By not acknowledging the demands placed on Asian students, it left them with little room for error. Asian students performed well because their parents create a network (Chuah, 2010). These parents consistently interacted with each other for the purpose of supporting successful navigation through academic institutions. It was an

unreasonable expectation to presume other subgroups can do the same. However, Blacks experienced this unequal comparison (Boikeo-Weyrach, 2017). This experience extended to their interactions with teachers and schools.

Moreover, to imply that other subgroups can compete was equally tricky. Attaining an equitable learning environment required educators to acknowledge and identified their hidden biases (Odemwingie, 2018). Teaching programs could progressively address such biases throughout their curriculum in multiple instances and had classes to continually speak to educational expectations and the threat it creates in learning environments. Countering the narrative that Black students were not interested in STEM or digging deeper into why disproportionately found in special education classes or other alternative programs, academics could evaluate the whole student using different instruments to measure these students' intellectual ability.

As suggested by K. H. Collins (2018), STEM identity played an integral part in how people see themselves concerning STEM. Based on a belief in their ability to leverage their STEM skills or STEM talents into a STEM career, the demographics differed among various subgroups. As they proceed towards becoming STEM innovators, they accessed the different STEM literacies over time. The factors affected a STEM student's growth and development depend on cultural, psychological, individual persistence, and living from a STEM perspective. They all contributed to the reinforcement of the mindset and framework (Collins, K. H., 2018; Gladden-Young, 2020)). In order to increase the visibility of Blacks in STEM careers, an increase of STEM recruitment and focused involvement from the schools is needed (Young et al., 2017).

STEM Dispositions

Young people often were susceptible to marketing techniques, so parents were cautioned to monitor what they watch or listen to various media outlets. For example, in popular video games, Blacks were mostly featured as urban dancers, street thugs, gangsters, and well-known athletes (Williams et al., 2009). Young people rarely saw Blacks called upon as experts (Charlton, 2019; Muro et al., 2018; Roberts & Mayo, 2019). In commercials, Blacks were also not represented as computer technicians or computer users but for less intellectual roles. How do parents guard against multiple messaging at school? McGee (2013) discussed the negative messages the Black students, especially Black boys, are regularly bombarded. For example, they experienced low expectations from teachers and school counselors, reducing and dismissing their math abilities.

Overlooking their adeptness disheartened any idea of engaging in a STEM career. Such neglect stifled innovation and equity (Roberts & Mayo, 2019). Transforming the narrative inside and outside of school was essential to allow the fragility of Black STEM identity to emerge, especially from urban environments where it was unexpected and often dismissed to uphold the prevailing stereotypes of urban Black students. The challenges Black students encounter were compounded by deconstructive messaging (Badger et al., 2018; Johnson, 2019). They included equating Black maleness with criminality, teachers afraid of their Black students, unequal access to treatment resulting in poorer health outcomes, interrupted early schooling impacting academic success due to long-term absenteeism (McGee, 2013, p. 2). Instead of, at minimum, tackling one to two of these multi-faceted issues site by site and creating a crisis of introspection where the staff (faculty and support staff) examined how their implicit biases contribute to these challenges. Until then, Black young men and women continued to be wary of pursuing a career

that will be more trouble and work than it is worth.

In the article, the contribution of HBCUs to the preparation of African American women for STEM careers: A case study, researchers used a case study evaluation to investigate the ways that Spelman College, a historically Black women's college, advocated the accomplishment and acknowledgment of Black women in STEM fields (Perna et al., 2008). Though this study based its finding on one institution, the outcomes showed how the ways that established traits, tenets, and practices may relieve the hurdles which restricted Black women's abilities in STEM fields. Drawing on the research study results, it closed with suggestions for enhancing policy and practice and recommending further research (Camara, 2013).

The noted studies highlighted Black students' perceptions in the collegial level nearing the end of the STEM education pipeline and explored the qualities of Black faculty who obtained their undergraduate and graduate degrees from HBCUs (Figueroa et al., 2015; Harper, 2018). It presented an in-depth understanding of the issues Black girls and women in STEM majors face, which is a subset of this research study (Harper, 2018; Young et al., 2017). It used a logistic regression assessment to separate the results of having an undergraduate or a graduate degree from an HBCU on investigation productivity. It included one measure of training, after controlling for other factors like background characteristics, undergraduate and graduates school experiences, current employment characteristics, and research activities. Another objective to investigate the contribution of HBCUs to the preparation of Blacks for faculty careers.

There was a small group of predominantly White universities making strides with Black student graduation rates. Harvard University led for many years. Part of the reason was the racial climate on campus. Some PWI created more favorable conditions concerning Blacks than at other college sites (Campbell et al., 2019; Simundich, 2017). A fostering atmosphere for African

Americans made a favorable impression on Black student retention and graduation rates. Brown University, known for some racial episodes, made strides by generating a safe and comfortable environment for their Black students. The opposite was for the University of California Berkeley, recently troubled by racial unrest (Johnson, 2019; Simundich, 2017). The dwindling numbers of Blacks on campus connected to eliminating race-sensitive admissions created an unfeeling impression from staff members to the student body, leaving many Blacks experiencing an unwelcome stance (Feagin & Sikes, 1995). These experiences were undoubtedly contributing to the even smaller number of Black graduates at Berkeley (Journal of Blacks in Higher Education, 2019).

When a major tech company was called out for not having a workforce that mirrored their diverse users, they brought in a recruiter who took on organization's mission with the intent of creating a company culture "where everyone here can thrive and people feel comfortable with being themselves" (Brown, 2020). Under public pressure tech firms announced measures to work towards bringing diversity and equity to their organizations. These initiatives did not last despite the inroads made. One example, the Sojourn program was favored for what it provided. It was a thorough social justice program designed for employees to learn about microaggressions and implicit bias. This training support how to have conversations about race and inequality. It was phased out with no plans for replacement and no indication why it was completed. It left more questions than answers. Its discontinued perhaps left a message with the employees regarding the importance diversity and inclusive environment (Agarwal, 2018; Glaser, 2020). Why was the closing of a popular program that could potential be a model of other organizations not covered as vigorous as when it was announced?

Educating Black Students

Ethnically Diverse and Foreign-born Students

A group of individuals experienced challenges were foreign-born students (Soremi et al., 2018). According to the 2010 census, 12 % of U.S. residents (40 million people) were foreign-born, and 11% of the native-born population have at least one immigrant parent (Walters & Trevelyan, 2011). Burt, Knight, and Robinson (2017) studied the mutual benefit of international students and U.S. colleges and universities' experiences. The opportunities for access and scholarship abilities added to the U.S. society and economy's fabric and knowledge base. The research explored Black men's perception in the engineering graduate school arena across different predominantly White universities (Burt et al., 2017). By specifically looking at international students, therefore, broaden perspectives and understanding of the Black diaspora instead of regarding all Black people as the same. The study examined the difficulties of navigating cultures, assimilating or not, and wrestling with oneself regarding the pressure to set aside one's home culture. How beneficial would it be for the international students to abandon their culture for the sake of fitting in the new environment? It was important to note that foreign-born or international students are voluntary immigrants. Therefore, their experience would slightly different from the other Blacks in the U.S. (Pinder, 2008). Foreign-born students tended to stay within their culture group, whether for safety, familiarity, and mutual understanding. Can the international student fit in if they are a person of color?

Black international students often experienced culture shock because they came from a society where they are the majority, becoming the minority within a minority (Soremi et al., 2018; Torres, 2009). Their culture and mores were different from the Black or African American culture though overlooked and experience similar micro-aggressive behaviors from other non-

Black students and faculty. They were made not to feel that they are a part of the school. Furthermore, both African students and children of African immigrants made up many Blacks enrolled in STEM courses. Demographically, they were distinct from Black Americans or first-generation children of African immigrants, though lumped together in the numbers (Joseph, 2018; Pinder, 2008). Does it benefit the student and institution if they assimilate and abandon their home culture to the new culture? In the US, assimilation was preferred. These immigrants encountered a double dose of biases because of their place of natality and their occurred race. The disconnect seems to come from how Black students and English language learners were treated and, therefore, managed in the lower grades (American Psychological Association, 2012; Wu et al., 2015).

Population Change

As the student body demographics changed over time, it is notable how the school environment switched. Therefore, a significant shift in teacher preparation programs was essential (Gershenson et al., 2015). As well as a dramatic readjustment requiring the training of a mostly White, female monolingual teaching labor force to interact with students from socially and linguistically heterogeneous backgrounds. Many programs claimed they successfully integrated multi-perspective and culturally relevant pedagogy into their curriculum (Aronson & Laughter, 2016). However, researchers found the contrary ((Bartolome, 2004; Darling-Hammond, 2001; Hammerness et al., 2005)). According to Gay and Howard (2000), teacher development programs and their teaching staff "must be held accountable for implementing quality multicultural education as they expect their students in K-12 classrooms" (p. 15). As a body of educators responsible for preparing a workforce that influenced and molded young minds, it was imperative they (student teachers) were keenly aware of their biases and ignorance

regarding various cultures. Predispositions of poor student outcomes were usually unconscious and are a relic of how people organize complicated material. In short, they needed to know what to expect, and they do not (Gay & Howard, 2000; Goff et al., 2014).

The teachers of color percentages increased except for the Black teachers. California, as a progressive state, had their numbers declined. From 5.1% to 4% of Black teachers in the workforce had an impact because it clear that students do better when they see themselves teaching (Freedberg, 2018; Ladson-Billings, 1995). It helped with student engagement, provides additional support and various role models. The barriers were present, including getting to the classroom and retaining them. Teacher preparation's financial investment was costly, coupled with the low pay positions, has not helped. As stated by the California Department of Education, the student to teacher diversity gap over time when comparing 1997-98 to 2016-17 showed that the Black student population also decreased from 8.8% to 5.6% while Asian and Latinx increased respectively 10.5% to 11.4% and 40.5% to54.2%. Even though the percentage of White teachers dropped (77.2% to 63.3%), they still consist of two-thirds of the teaching force.

Black English Learners

Training teachers to do due diligence in researching, listening, and implementing culturally responsive pedagogy reduced potential mishaps, created a safe learning environment, and supported the learner (Boffone, 2020). The student may not see themselves in the textbook, but the teacher’s lesson supplements what was missing and engaged through the student’s lens — understanding the history and misconceptions of Standard English Learner (SEL) and English Language Learner (ELL) informed how to deliver the content in a meaningful manner (Ladson-Billings, 1995). Buy-in happened quicker from both the student and their parent(s), resulted in stakeholder support and backed the school, allowed teaching to flow. This skill was keenly

essential for the first and second-year teachers to know their students, the surroundings, and crafts (Boffone, 2020; Ladson-Billings, 1995).

Once a teacher graduates from a teaching institution, it was a declaration (to the state) of competence in instruction to all students by both the student teacher and their education program (Greenberg et al., 2011; Indiana Department of Education, 2021). The school site, therefore, trusted the teacher will fulfill the duties and impart the curricula effectively. Anything short was a breach of confidence in the educator and the educational program, ensuring a low rating and less recruitment. Educators avoided the "soft bigotry of low expectations" by maintaining and expressing high expectations for every student (Gershenson, 2015). Though these new teachers were new to the profession, their willingness to take on culturally responsive teaching begins a teacher expansion journey from the onset (Ladson-Billings, 1995; Villegas & Lucas, 2002). Likewise, veteran teachers benefitted in their growth and development to be reminded of their duty of support, nurture, and facilitate student excellence. Thus, resulted in parent allies supported their classes and students rising to high teacher expectations and state benchmarks.

School districts in California recognized most Black students fell within the realm of standard language learners where their first language is English but not academic language (Woo & Curtius, 1996). Many untrained educators taught Standard English learners (SEL) and often resistant to teach culturally linguistic or responsive pedagogy to standard English language learners (Wheeler, 2016). One correction was for it to be ubiquitous in the teaching programs. Part of the resistance stems from highlighting the uncomfortableness it placed on a teacher to interact with their cultural awareness (Gershenson, 2015). Not acknowledging Black students' historical culture and mores and helped them navigate the academic world's norms. Often discounted, the student disengaged and acted out as a protection form because their personhood

is not respected (Ladson-Billings, 2006).

As Boschma and Brownstein (2016) stated, three-fourths of the student population experience deep economic isolation, designated as low-income and, researchers found a divergence between poor Whites and poor Blacks. The low-income Whites concentrated in schools where they make up 75% of schools' socioeconomic landscape in four cities. Contrasting to 51 cities, Black students appeared in schools amassing high levels of poverty. This barrier seemed to represent a complex and significant issue that bars the possibility of opportunity. PolicyLink director Sarah Treuhaft commented that,

> It's the hardest nut to crack because these issues are so deeply entrenched [due to] the housing issues that have created segregated communities. Bussing is a challenging solution. People like to attend their neighborhood schools, and there is so much pushback on integration. There are deep structural issues that can't be tackled one at a time (Boschma & Brownstein, 2016, p.8).

The absence of social discourse regarding poverty and its consequential effect continued to keep an underclass and problem regenerates. Not tackling the issue allowed for ignorance and misconception to persist.

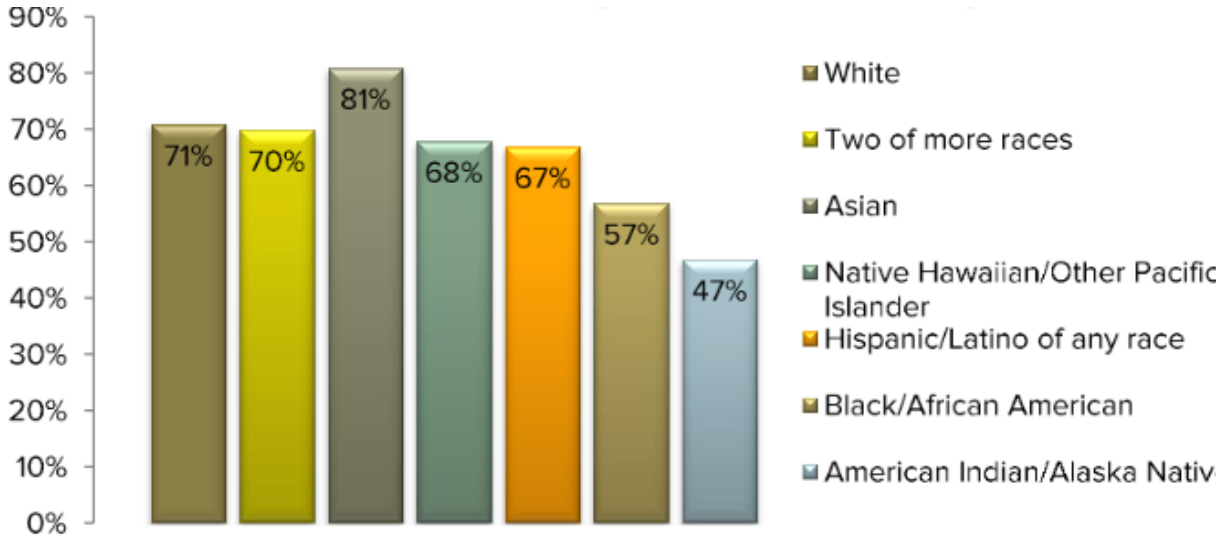
Black students attended underfunded schools or schools with fewer resources were unlikely to be college-ready (Byrd & Lopez, 2020). Metrics used to track student success trajectories like Advanced Placement or upper elective courses in mathematics and science, SAT and ACT scores, secondary school graduation rates have little participation by Black and other minority groups (Anderson, 2019; Jaschik, 2015; Journal of Blacks in Higher Education, 2008). These students did not possess the essential skills to participate and thrive in these courses. As a result, antiquated structures discounted Black students before they had a chance to access

college-ready courses, which prepares students for post-secondary schools' expectations where self-sufficiency is necessary (Camara, 2013). Figure 2.3 showed the breakdown of the accessibility of rigorous courses for college readiness. As 57 % of Black students attended schools with college preparatory courses available and how many of the Black students enroll in these STEM classes?

The underrepresentation of Black students in the programs like Advancement via individual determination (AVID) and Gifted and Talented Education (GATE) demonstrated the deficit thinking present in school sites (VanTassel-Baska & Stambaugh, 2007). These programs supported the college-going culture and expect students in these programs to participate in Advanced Placement courses and prepare for the SATs. Accessibility was a cornerstone of these programs. The unequal distribution of the Black students in the GATE program also showed there is more work to be done, leading the faculty to seek out or recruit Black students (Nicholson-Crotty et al., 2016; Weedy, 2019).

Figure 2.3

Student Preparedness and Accessibility



Note. Accessibility and preparedness of students across by subgroups (Bryant, 2015)

Misalignment Between Stakeholders

Parents were another stakeholder that is often overlooked and misunderstood. The misunderstanding came from the lack of communication between the other stakeholders (teachers and administrators); therefore, not taken seriously. This miscalculation was prevalent regarding the Black community (McGee & Spencer, 2015; Yull et al., 2018). How can Black parental support be leveraged such that it is an indispensable asset in the fabric of the school community?

Parental Involvement

Archer et al. created a study looking at science capital and how it influences science achievement (2015). It appeared that the more science capital parents have, plays a facilitating role concerning science aspiration in a child (Archer et al., 2015). It also seemed that affluent families hold substantial social and science capital, therefore, providing cultural and economic

support as well as resources for achievement. According to the researchers, they saw science capital:

> as a conceptual device for collating various types of economic, social and cultural capital that specifically relate to science—notably those which have the potential to generate use or exchange value for individuals or groups to support and enhance their attainment, engagement or participation in science (Archer et al., 2015, p.5).

Therefore, tying the wealth of the family with the achievement of the child increases capital. The share of science capital was deeply classed and racialized, being more dominant among the middle class and White and South Asian families. In England, longitudinal data gathered to examine students from some minority ethnic backgrounds like for instance Black Caribbean people were less likely than their White British counterparts to be entered for higher tier test papers, irrespective of past achievement, therefore limiting their possible success (Strand, 2010). Low results led to a restriction in options for upper division classes. It perpetuated the cycle of participation, added to the discourse regarding socioeconomic status as a contributing factor, and data continued to low rates of contribution within the Black Caribbean students.

The misunderstanding and the miseducation of middle-class teachers were apparent regarding the lack of engagement school sites have with Black parents (Gershenson, 2015). The manner of how Blacks congregate was neither studied nor employed for the benefit of Black student success. Let us quickly compared the perception of Black voters. According to Principal Henry Fernandez from the African American Research Collaborative, he believed in the political force. Black women possessed political will, based on their large attendance in favor of progress. Their consistent drive and voting approach often showed their commitment and enthusiasm for

transformation (2018). Politicians often had seen visiting Black churches to meet with congregation elders and leaders to find out their needs. Deals made to ensure Black voter support. It was interesting that Black parents are not sought out similarly (Yull et al., 2018).

Executive Director of the Advancement Project, Judith Browne Dianis, suggested it was incorrect to think that Black people were disinterested, unconcerned and indifferent (Curtis, 2017). Their presence was a commitment to a promise of a progressive future. If Blacks were seen as a pillar of a voting block where is the disconnect in schools? Why wouldn't they be just as passionate for their children? The answer is they are (Adams, 2019; McGee & Spencer, 2015; Shapiro, 2019). How they were engaged and treated makes a difference. When they arrived at school, then what? The school site was unwelcoming because when a Black parent enters to advocate for their child, apprehension from school staff is their first encounter (Education Post, 2018). The Black parent experienced being ignored, unseen, and past over (Yull et al., 2018). Time were an important factor and commodity for Black parents. Many experience their presence was underutilized and therefore, ineffective. Parents also felt that teachers do not know what to do with them therefore, they cannot afford to waste their time volunteering. Others had financial obligations that requires them to work passed school hours and the school site have not impressed the importance of their participation, especially in the secondary level. As result their absence created a false narrative and misunderstanding and often read as being uncaring or uninterested (AchieveMinneapolis, 2016).

Communication was valuable especially between teachers and parents (King, 2019). Getting a negative note as the first attempt of communication results in the loss of parent support especially from a group of people who traditionally distrusted many forms government entities. According to Williams (2015) "school is a part of a community of parents that interact and

network with one another; upon receiving personalized messages, it becomes clear to parents that the teacher sees their child" (p.1). Otherwise, Black parents saw this action as a lack of investment in the children overall well-being because they see their children as more than their behavior. Another form of communication was presence. Teachers who had been successful in gaining the support and trust of the Black parent often appear at public or school events hosted by the school. According to Jones and Jones (2007), this "gives students and the community a chance to view teachers in a personal light and increase positive teacher-student interaction" (p. 90). Such actions were not widely shared as means in strength school and parent relations. This idea could be shared new teachers who may be malleable and eager to create strong ties with their Black students. This show of reciprocity demonstrated commitment to community. Perhaps a missed opportunity to gain support of an important stakeholder, the parents (Jones & Jones, 2007; Williams, 2015).

An example of a growing distrust among Black parents over the years, was the continual decline in accessibility in schools where their children have previously attended (Shen-Berro, 2020). In New York City, Mayor Bill DeBlasio proposed a measure that would level the playing field and bring equity for Black students pursuing a spot in the coveted specialized high schools (Shapiro, 2019). The number of places offered to Black students has consistently dropped for the more than a decade, and the spots offered to Asian students increased by 400% (NYC City Council Hearing on School Diversity Measures, 2019). For fall 2019 school year, seven Black students were offered seats out of 895 spots for one of the elite STEM school in New York City. Unfortunately, it grew as an accepted reality and little has been done to plug the hemorrhaging places to other cultural groups. The demand for the seats increased the competition. The competition fueled by increased preparation. This practice boxed out more Black students and

their potential increased of their science dispositions (Young et al., 2017).

Wealthy parents or parents with means started their children studying at an earlier age to get into the coveted curriculum (Jaschik, 2013). This preparation increased the passing rate, which required more studying and more training. Income challenged parents could not and cannot keep up with the demand. Asian culture groups were challenging the mayor's proposal citing the unfairness (Shapiro, 2019). No one had discussed how they got to this situation of inequity in the first place. Examining the question of how did the displacement of some many Black students occurred in these elite schools? And why the failure of addressing it led to such a decline? The reluctance to dive in these difficult discussion kept the educational divide. The lack of advocacy for Black students to participate in elite public schools continued to keep them out of this pathway to STEM fields and programs.

The manner to which Black parents provided support was different from the expectations of a typical middle-class teacher (McGee & Spencer, 2015). Plenty of discussions regarding the value of education was happening at home. How can parents reinforce learning in class at home? Instead of contacting parents after the unhelpful behavior already rooted (Graham, 2015).

Parents must fight for every inch regarding their student's education (McFadden & Bush Koch, 2016). Receiving funding or services was the first step, but many parents unaware of the newfound support and missed the opportunity of using it because of the inadequate infrastructure (McGee, 2013). The information not disseminated, and the support is either wasted or used on other cultural groups who have a stronger social network, informed, and had figured out how to navigate the school system.

So, involvement in essential and how parents were engaged makes a difference. According to the Southwest Educational Development Laboratory (SEDL), programs, and

interventions made the most impact are the ones that are teaching parents the connection between school learning and supportive home learning (Henderson & Mapp, 2002). Sharing ways that empowered parents to support their children at home with accountability and follow-through measures leading to higher student achievement (2011). Though parents and teachers believed the other means well and their shared goal of increasing student comprehension made a difference because there was a disconnection between all the stakeholders regarding how to best support higher scholarship among students (Conus & Fahrni, 2019).

Parents desired to be involved in their children's education (Williams, 2015). Teachers and schools believed that involved parents benefit children (Cooper, 2009). However, good intentions on either side only go so far. As noted by Epstein and Sanders (2000),

> Teachers, parents, and students have little understanding of each other's interests in children and schools. Most teachers do not know the goals that parents have for their children, how parents help them learn, or how parents would like to be involved. Most parents do not know much about the educational programs in their children's school or what teachers require of them (p. 2).

Active parent engagement came when a true partnership exists between schools and families. This partnership included respect between stakeholders where parental voice was valued and essential to building strong collaboration (Cooper, 2009; Montpas, 2019). Supporting that partnership, especially around academics, was what works for student achievement. The reflective component required from stakeholders and the forum structured that allow for them to share the needs. Clear accountabilities stated to have all win. In the end, the objective supported students thrive through partnership and community.

Science Literacy and Responsively Teaching

Reading, writing, and mathematics were basic disciplines used by testing agencies. National exams like SATs, ACTs, and SBACs give schools, parents, and other institutions an idea on how students fare. However, science literacy needed all three in action to communicate understanding.

Science literacy had not been thoroughly investigated despite adequate research on racial and ethnic inequalities in math and reading ability, the lack of representation in STEM and health fields, the disparities in health assist awareness within different communities of color and the academic success of their children. Moreover, the ability to maintain and retained gainful employment relies upon the amount of science literacy one possesses (Career Academy Network, 2012; Gentile, 2012; Katz et al., 2016). Such capacity enriches one's life by making sound choices based on the latest information that benefits the family (Noonan, 2017; Smeeding, 2016). This enrichment influenced the surrounding community at large. Unfortunately, the volume of literacy was not shared across different communities resulting in an uneven allocation on wealth and knowledge and ultimately created a disadvantaged class unable to access critical levers that elevate the living conditions. Starving these communities also created them as lower-tiered groups subjected vast more disparities (Horowitz et al., 2019; Smeeding, 2016). Such domination kept the status quo with Black communities consistently underserved and at a disadvantage. Though the attainment of science literacy spoke to a portion of the obstacles that Black people encounter, it also began to explain the foundational inconsistencies that led to socioeconomic success and other literacy deficiencies Black students experienced from the onset of schooling (Bowman et al., 2018). Fostered insecurities and distrusted within the communities, led to turn-off or working against any form of new information regardless if it had the potential

to increases one's quality of life. It was seen as unattainable and not needed.

Therefore, marginalized children required culturally responsive teachers to engage the content in meaningful way (Villegas & Lucas, 2002). Understanding the content for mastery, delivering with instructive skills, and be culturally proficient allowed these teachers to make significant connections. It also gave rise to uncovering the importance of a child's worldview and build upon what they carry to the learning community. Working from the theories like Critical Race Theory (CRT) and Culturally Relevant Pedagogy (CRP) helped the educator account for what the students may be or are experiencing in their daily lives (Ladson-Billings, 2015). This practice created a bond between the teacher and students as well as build credibility. Such an educator who used various cultures' educational values skillfully increases the engagement in their class (Darling-Hammond et al., 2020; Sabin, 2015). Therefore, reaching their pupils so that the average teacher cannot because of navigation privileges CRP and CRT application provides (Gay, 2010; Villegas & Lucas, 2002). It may be because they did not practice the notion of "othering," where it sidelined and ostracized students by describing them by their developmental needs versus their attributes (Muhammad, 2020). Furthermore, Gay contended that including prior knowledge, student experiences, and the teacher's identity make the most impression on student learning.

Engaging in theories like CRT and CRP increased the equity experienced by students. They were seen not only as worthy but had the ability and opportunity to learn.

Programs and Curriculum Models

San Diego STEM initiative had rolled out programs that had more than benefitted their students by providing them with experience and exposure to various areas of STEM (San Diego STEM Ecosystem, 2020). The three we were looking at are the Health and Science Pipeline

Initiative (HASPI), Project Lead the Way (PLTW) and College Ambition Program (CAP).

HASPI was a multi-pronged program that considers how to support the various stakeholders to drive and sustain the program (HASPI, 2006). Their partnerships included industry, college, and university, creating a connection to real-world application in the healthcare and medical industry. The apparent collaboration and reason for the initiative. Grabbing the attention of students was essential; therefore, they worked with middle and secondary schools to deliver the tools they have to offer to build a pipeline of success (HWI, 2020). HASPI resources aligned with the National Standards known as Next Generation Science Standards (NGSS) and Common Core State Standards (CCSS). Allowing teachers to use the materials, created thematic projects gave an added dimension to the school curriculum (HASPI, 2006). When the student can saw how the various disciplines connect, then it established "buy-in" for students, teachers, and parents. Students learned early on if healthcare was the pursuit of their career path because it is not isolated in the science classes alone. Teachers worked together across disciplines. The students got the whole picture, and as teachers delivered the program, their craft evolved. The advantageous part was that the curriculum was accessible via the internet. Supply cost varied on the discipline (HASPI, 2006).

Project Lead the Way (PLTW) evolved to provide a transformative hands-on approach for the STEM curriculum (Hess et al., 2016). With three essential pathways (biomedical, computer science, and engineering) designed to engage students and educators, leaving them inspired and empowered to help others. They presented real-world problems, and through problem-based and project-based learning, students worked together tackling various issues to invent new solutions. Teachers trained to help the student develop critical skills necessary to compete in the demanding world of STEM (Nathan et al., 2011). The evolution of PLTW grew

from just a secondary level engineering program to becoming a multilevel, multi-discipline Pre-K to 12 programs. They created a formidable pipeline guiding students and parents through the various levels (AAPCHO, 2009).

Understanding the principle benefit of STEM immersion as early as possible is vital to create a culture of collaboration and critical thinking. Weaving analysis at the introduction of the school curriculum was a game changer (Figueroa et al., 2015). Creative solutions came from practice. By engaging students, they developed 21st-century skills like problem-solving, thought critically, effectively communicated, cultivated grit by overcoming adversity, they equipped themselves to take on reoccurring challenges. Such transferable skills became empowering and trickled into the home. Students tended to solidify their commitment to a field of study during secondary school (Van Overscheld, 2013). They started to look for various avenues giving insight on the particulars of that study (Katz et al., 2016).

Pipeline programs like HASPI and PLTW were possible routes to increase STEM recruitment of Black students. However, some drawbacks pointed to a failure in increasing enrollment and retention in underrepresented groups. For example, female students had not shown improvement in retention in STEM research majors from these pipeline programs (Pell, 1996). Efforts had been made to increase participation in advance degrees and the loss of minority learners to other pathways is known as the "leaky pipeline"(Pell, 1996). Pursuing alternate pathways fulfilled on family commitments was one of the suggested reasons for such exits. As a result, engagement efforts to understand these departures had led ways to join these commitments with supportive careers that aligns with community health and advancement (James et al., 2012; Katz et al., 2016). The approaches boosted interest include joint or augmented degree programs, regional connections with colleges and universities impacting

underserved communities, STEM majors and articulation agreement with community colleges (Danek & Borrayo, 2012).

There were many interventions modeled to mitigate the stress of the college preparation path for students and families. One intervention eased the tension and tailored it to meet the school site's needs is the College Ambition Program (CAP). This intervention linked integral facets of college preparation design with STEM pursuits. They provided the much-needed information to students and their families seeking STEM careers but did not know how to convert their interest to action. CAP presented learners with a series of services to assist their STEM goals. The benefits included tutoring and mentoring, college and course advising, financial aid guidance, and college exploration field trips (Schneider et al., 2013).

Initiatives and Policies

Achievement Gap

The achievement gap was the unrelenting inequality existing in scholastic success between marginalized and disadvantaged students and their White peers (Duncan et al., 2007; Garcia & Weiss, 2017; Schenke et al., 2017). What has perpetuated this disparity is the fortune of one group chances over the other to learn. Over time, this chance became deliberate and intentional. The wrapped-around intention morphed into an obelisk and served as a constant challenge for other groups to overcome (Boikeo-Weyrach, 2017). The learning opportunities and accessibility impacted ability but had often been collapsed together or mistaken as equivalent. Black people were not originally afforded education (Darling-Hammond et al., 2020). As one traced the historical implications, over time, decisions left to people who did not make the distinction between ability and accessibility put the U.S. onto a path of academic decline (Estrada et al., 2016; Johnson & Watson, 2005; Malcom et al., 2016).

Brief History of the Achievement Gap

Starting with the imposed regulation of Black Codes, a form of limitation that freed African slaves coped with even though they serve during the Civil War (Bigelow, 1970; J. M. Richardson, 1968). This policy kept freed Slaves illiterate, leaving reading, or writing teaching for Whites only. Though discontinued during Reconstruction, it restructured into Jim Crow laws. Homer A. Plessy v. H. John Ferguson case legalized segregation and used the idea of Separate but Equal to legitimize Black schools to be severely underfunded (McBride, 2006). The court case of Oliver Brown et al. v. Topeka Board of Education helped and hurt the cause for equality (History Channel, 2021). The ruling highlighted substandard physical facilities and poor conditions. Almost 60 years later and the office of the Civil Rights Division struggled to dismantle the segregated public schools. Due to the consent decree, it allowed school districts across the country to name their timeline for integration (U. S. Department of Justice, 2015).

The vestiges of segregation existed. For example, in Monroe City, Louisiana the disparity between two high schools based on the demographic demonstrates outright inequity (Barrett et al., 2018). The first school with a 100 % Black student attendance were given by the district five gifted and honors classes and no Advance placement course offering while the second school with about 43 % White student enrollment accessed close to 70 Advanced Placement, gifted and honor classes (Andrews and U. S. v. Monroe City School Board—Second Amended Consent Decree, 2017). Though the decree required same classes to be offered to all schools, it did not say by when, which classes it had to be, and what steps it had to take. Fortunately, an agreement took place in 2010 (The U. S. Department of Justice Archives, 2014). Brown II was a concession making both sides satisfied by slow walking to equality, avoiding conflict and ushering desegregation painlessly. But for who? Such unwillingness for clarity emboldened opponents to dig deeper and use it as reason slowing school integration (Ogletree, 2004). They claimed their

defiance are based on the reluctance of the justices not to outright call for immediate desegregation in schools. Therefore, laying the groundwork for glacier movement slowly exposing the fertile soil of inequalities and disparities present in U.S. public schools. The Separate but Equal premise was prejudicial (Roche, 1951). Enrollment in Black colleges decreased when Black student chose predominantly White institutions to attend. Student enrollment drove the institution's funding. Before the court case, Blacks could only participate in Black colleges, primary and secondary schools (Office for Civil Rights, 1991). After the case, the promise of prestige, migrated of talented students and Minority Serving Institutions (MSI) receiving less funding added to the gap (Freeman, 1999; Scott, 2017).

Activism was a necessary tool as Black students integrate into schools. Black students used this tool for educational justice and to level the playing field for all. According to Dr. Muhammad, these students formed a list of demands, which included abolishing all New York State Regents examinations, altering teacher population and exams to provide Black teachers proportional to the student population, and reorganizing high schools in their communities. Hence, they avoided going outside hostile neighborhoods to get an education, to name a few (Muhammad, 2020). A small local paper published this list. Its purpose called attention to the inequities that exist in 1969 and still exist today. Unfortunately, not much has changed.

The Present

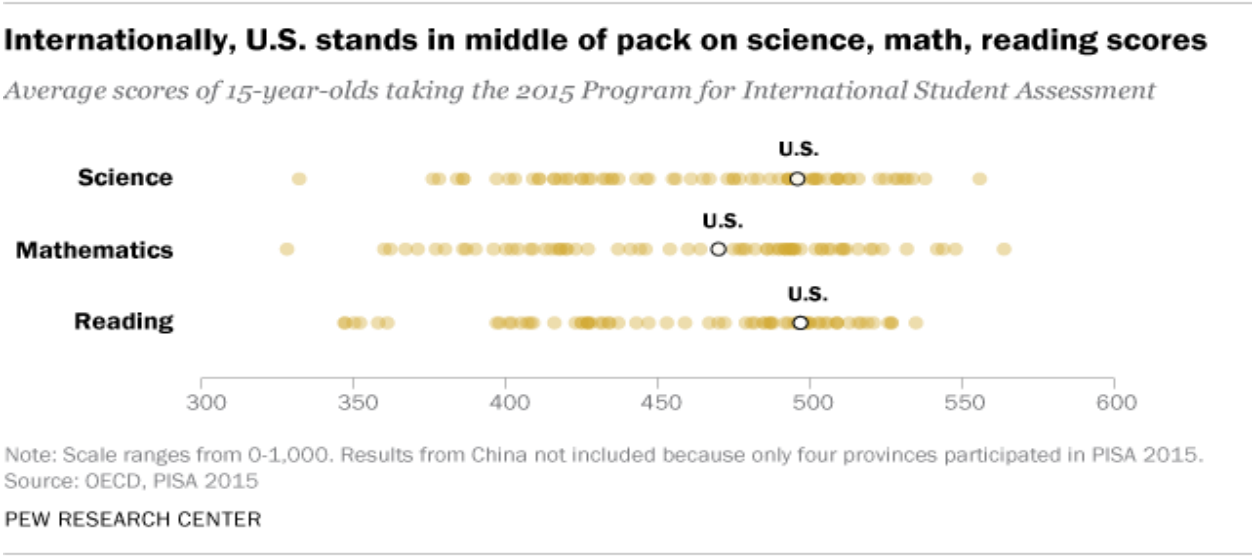
The United States was internationally known as a place for forward- thinking. Parents send their children to the U.S. to get a global education (Barta et al., 2020). The academic prowess once possessed, was unsustainable. Over time, the missteps and prejudicial policies created a vacuum where other countries capitalized — leaving the U.S. behind (Strauss, 2020). Too many students were not meeting basic standards or benchmark and barely competing with

international counterparts (Bybee et al., 2009).

Figure 2.4 discussed how U.S. students compare with their international counterparts (DeSilver, 2017). According to PEW Research Center, based on current leading cross-national exam scores administered out of 71 countries, the U.S. placed 38th in math and 24th in science in 2015. Programme for International Student Assessment (PISA) test measures reading ability, math and science literacy, and other skills among 15-years in dozens of developed and developing countries (DeSilver, 2017).

Figure 2.4

International Standing on Science, Math and Reading Scores.



Note. U. S. Students Compare with their International Counterparts (DeSilver, 2015)

The variation between Black and White students became apparent by age three or four, where the school readiness shifts (Duncan et al., 2007). Indicators showing over time the gap increases maintained and amplifies (Ferguson, 2014; Hanushek, 2009). According to the Center on Standards, Alignment, Instruction, and Learning (C-SAIL), researchers found during the school year, the achievement growth rate of Black students was equal to their White counterparts

and decreases during the summer with Blacks experiencing a more significant drop (Porter, 2020). Therefore, the gap remained constant, with no gains while in school. Researchers agreed that the racial difference in students' performances shows up before schooling (Ainsworth-Darnell & Downey, 1998). Then after examining trends from three pivotal developmental periods —early childhood, primary and young adulthood, multiple factors compound the gap underlined by a multitude of circumstances. Ironically, the gap increased as high achieving Black students enter the school system, experiences unchallenging and low-quality pedagogy causing the achievement exam scores to fall (Hanushek & Rivkin, 2008; McGee, 2013).

Recently, preschools became a place of expulsions and suspensions (Anderson, 2015; Malik, 2017). The consequence was the loss of early education alignment, time loss, the denial of access to academic opportunities. This "push out" phenomenon had become increasingly concerning to the field especially given the disproportionate rates of early childhood expulsions for boys, Blacks, and particularly Black boys (Gilliam et al., 2016). The number of suspensions is higher than their White peers, and depending on the state, preschool was not required (Malik, 2017). Therefore, Black students made less than 20% of the enrollment in general; however, account for almost half of the suspension. The inability for preschools to found a concrete base or restorative way to deal with behavior sets up Black students to see themselves poorly and therefore act out as often leading to more suspensions or expulsions (Anderson, 2015; Goff et al., 2014).

Moreover, Black boys were three times as likely as girls to be suspended one or more times (Dillon, 2010; Graham, 2015). Derailing any continuity or growth, they may be experiencing in their formative classes. In comparison, White students represented 43% of preschool enrollment, but 26% of preschool children receiving more than one out of school

suspension and suspending Black girls at higher rates (12%) than girls of any other race or ethnicity and most boys according to the office of Civil Rights (Office for Civil Rights, 2014). The existing disparity showed the disproportion of disciplinary actions and irregular implementation of discipline policies to all students. Therefore, damaging the stability of school site racial conditions (Goff et al., 2014; Quick, 2018; American Psychological Association, 2012).

The woefully undertrained staff created opportunities for improper use of strategies meant for student success (Aguilar, 2011; Fensterwald, 2019). Strategies like self-reflection identified possible biases and perceptions which is out of the educator's consciousness (Gay & Kirkland, 2003; Safir, 2016). Advocating for this practice created openings for growth and development and brought to the surface why certain behaviors seen as "troubles" arose with Blacks for example (Goff et al., 2014). Effectively responding to the racial disparities which disproportionately affected Black students in education demonstrated understanding. Other actions included bringing adequate attention to inequities and underutilized practices. Unaddressed questions in a youth learning environment (e.g., how early education is made available, accessed, does early exposure make a difference, and how responsive it is to students' needs) that significantly influence students' outcomes is critical.

According to the Hanover Research, distilling the study into functional outcomes regarding school centered approaches reduces the achievement gap (Hanover Research, 2017). The approach concentrated on the following areas, stakeholder partnership; school culture and engagement; cultural competency; family involvement; targeted proficiency access points, and college-bound goals. The concept of closing the achievement gap with multiple ways of accomplishing it and how it is perceived are possible starting points. "Describing the gap as an

"opportunity gap" rather than an "achievement gap" shifts the focus to the factors that lead to unequal achievement, which often include factors out of students' control" (Hanover Research, 2017, p.5; Quick & Kahlenberg, 2019). Focusing away from a limited view to an empowering outlook created the chance for transformation to occur. The opportunity allowed for general changes, discovered new things and execute ideas, concepts, and new fascinations better than before whether collaboratively or alone. Moreover, searched and unearthed unknown areas to pinpoint possible improvements increases one's growth and development, producing fertile ground for other future success.

The critical gaps in performance demonstrate the unfulfilled basics and misuse of public investment (Symonds, 2004). Leaving behind unused and available abilities amongst disadvantaged children slows progress sustaining a feedback loop of underprepared students (Darling-Hammond, 2001). Societal talents uncultivated due to accessibility perpetuated an underclass leading to depressed future economic prospects and decreases social mobility throughout family generations (Reeves & Pulliam, 2019). The American dream became a letdown and anticlimactic for large portions of Black people (AAC&U News, 2017). Shared responsibility dissolved, opportunities for the few.

The promise of the 21st century became one of the rallying points where the education and employment sector met (Christen, 2009). The job market expressed what was missing and needed. The education sector looked at these wants and transformed them to a set of skills that further support student growth and were transferrable to land them profitable careers (Christen, 2009; Shafie et al., 2019). It demanded teachers to increase their capacity and moved toward mastery of instructional skills. This approach also required a caliber education for all from schools by creating instruments measuring 21st century skills outside of reading, writing, science,

and arithmetic. Such an initiative brought Blacks students back and be indispensable because part of their curriculum would be growing their marketability and competitiveness. This process in turn increased confidence, participation, and achievement. American students needed to compete with more than core subject skills and many of them were only maintaining basic competencies according to PISA2003 (Organization for Economic Cooperation and Development, 2004).

Acquiring highly skilled positions called for incorporating 21st century skills across the disciplines and it was equally important that teachers developed and measured them from students (Kutlu & Kartal, 2018; Shafie et al., 2019). These skills were quite similar to what are culturally taught, roughly used for daily survival, and generally supports the Black collective commitments. There was a real opportunity for Blacks to show their prowess by using their cultural pedigree to show the different ways to answer questions and demonstrated understanding (Scott, 2017). The traditional ways of the teaching had to upgrade to exist in this new criterion (Tarbutton, 2018). The polls showed 80 % of voters say new skills are in order to in attaining 21st century jobs (Partnership for 21st Century Skills, 2008). There was an overwhelming support by the American voters, and renewed belief in the new direction the nation's schools were pursuing, and it did not last for long. Unfortunately, it seemed to fold into the cemetery of buzz words and initiatives (Moran, 2018). As it fell prey to the next national initiative and though there is some mention of it subsequent programs. Content became the only priority again. These skills became secondary or tertiary for most and soft skills for the elite once more.

Every Student Succeeds Act (ESSA) was an educational law signed by President Obama on December 10, 2015 to expand essential areas of progress made by key stakeholders (Burnette II, 2019). It replaced a former 2002 educational law, No Child Left Behind (NCLB) that

highlighted student progress, provided additional support regardless of background, location or disability and expanded accountability (Klein, 2015). NCLB needed an overhaul due to demanding requirements from districts, schools, and teachers. A more workable law was needed to concentrate on clear objectives to groom all students for post-secondary success. Welcomed by most policymakers, this act reactivated a previous law, the Elementary and Secondary Education Act (ESEA), committed to equal opportunity for all learners (Klein, 2015). Under ESSA, more achievements like improved high school graduation rates and low dropout rates would have the necessary resources to continue. While more students choosing college as their next education step towards promising and lucrative careers, a steadier groundwork would be put in place expand student outcomes across all grade levels. One of the terms under ESSA called for state's report card releasing publicly school expenditure data (U.S. DOE, 2020). What supports could reengage states to reach students equitably while continue the current progress?

Race to the Top

The Obama administration created a policy stimulating the states to compete and embrace innovation (U.S. Department of Education, 2009). Setting aside $4.45 billion for a competitive grant program aimed to align state-level policymaking on college preparedness, support teacher efficacy, innovative data systems, and bringing attention to chronically low performing school with additional support (U.S. Department of Education, 2010). This rigorous evaluative process involved the state analyzing their current issues by prioritizing specific education policies, then outline future goals and outcomes. The states were scored based on six categories (state success factors, standards, and assessments, great teachers and leaders, informational measurements to support instruction, turning around lowest performing schools, prioritizing educational funding) and competitive preference (U.S. Department of Education, 2010). States were not left alone to

their own devices with the financing. Their accountabilities included submitting annual performance reports, accountability practices, and site inspections. States could attain 12.5 % of the funding to begin their plan and receive the balance after the approval of a final range of work, outlining the specific outcomes and timelines from the participating local education agencies by Education Department. Urging participating and non-participating states established goals for accomplishment and put forth redesigns which were “ambitious but achievable” (U.S. Department of Education, 2010).

The influence of Race to the Top (RTTT) grant reached more than the winning states. It impacted the losing states as well (Weiss, 2013). For instance, Illinois did not win the first round of applications, however, chose to implement a significant revision of the evaluation protocol for teachers and principals known as the Performance Evaluation Reform Act (PERA). The grant program inspired the Illinois lawmakers to push past their former worries that may have caused apprehension and chose to execute bold policies (Weiss, 2013). Their persistence resulted in winning the funding. Policymakers adopted educational reforms that outpaced legislation from previous administrations (Hamilton et al., 2002).

Students expected to meet graduation standards despite confronting socioeconomic hurdles; it became increasingly difficult with substandard resources (Boschma & Brownstein, 2016). Many Black students attending high poverty schools faced these expectations daily; therefore, the attention this initiative had on addressing the chronically lowest-performing schools create at least an appearance of accountability (Onosko, 2011). By putting forth an outline of how the state and local educational agencies intended to address the issues facing these schools is a significant step (Weiss, 2013). Highlighting the racial achievement gap and their impact on academic success created the opportunity for discourse regarding economic and ethnic

isolation of students within schools with low socioeconomic status (Brownstein, 2016). More people lived in communities that were either poor or affluent, with less integration occurring as ideally found in middle-class neighborhoods (Garland, 2012). Such communities led to less inclusion and less diversity in the schools. The feedback loop created of "having financial security" as a dream and economic struggle as the norm (Picchi, 2019). The connection between economic policies, housing policies, and racial segregation compounded, influenced the schools and neighborhoods (Rothstein, 2017). Therefore, leaving Black and Latino students attended struggling schools, most of their lives inevitably churned out 68% graduation rate (Boschma & Brownstein, 2016).

Limitations to RTTT and Therefore Achievement Gap

How effectiveness was RTTT? The Race to the Top program had its limitations because it was meant to be the push states needed to address chronic problems, leaving it to the states to deal with the details. Introduced in June 2009 and purposed with a four-year timetable ending in 2014. Did the catalyst work, and how do we know?

The lack of available information to breakdown the complexities of this initiative in action in the different states is one of the challenges of evaluating the effectiveness of the grant program (Gershenson, 2015; Weiss, 2013). Annual reports are by States with only two in-depth reporting by the Center for American Progress (CAP). Other reporting of dissent regarding RTTP should be incorporated to get the full scope of its effectiveness. However, our stable and reliable mode of getting relevant news, the media (national, state, or local) conduits did not cover educational concerns with the veracity they had in introducing the initiative. As a result, fewer journalists assigned to examine the crucial realities and significant challenges of the details (Casey, 2019; Mervosh et al., 2019). The outlets focused their attention to political capital,

funding allotted, and disinterested in the human capital is affected. Having an in-depth analysis influenced lawmakers to adjust and apply necessary modifications in the aftermath of loathly initial goals (API, 2019). Though honorable, raising student achievement and closing achievement gap without tackling the underlining issues which perpetuated the gap proved unrealistic.

Postponing the revamped teacher evaluation systems due to inadequate time to acquire rubrics, pilot them, then train evaluators proved to be more difficult in achieving than anticipated (Strauss, 2013). Improving instruction promised, but the evaluation system focused on test scores looking closely at math and reading skills, leaving the other disciplines behind as background props and afterthoughts. The evaluative process struggled with how to assess non-testing subjects and teachers with young students (Weiss, 2013). Also, unqualified, and uncertified new teachers continued to be recruited to teach in high need schools. The lack of experience continued to plague these schools with a higher percentage of novices, not having the fidelity to implement much-needed strategies to support students who needed them, while other schools benefitted from experienced teachers (Garcia & Weiss, 2019). This recruitment added more tension with union and management differences. Many Black students were at the effect of these policies that impact student success. Tackling these issues in a multi-tier offensive may not be promising if only stops at teachers and schools. It must continue to the districts, states, and the surrounding communities. The initiative tried to do too much without comprehensively concentrating on the chief problems with too few people or entities accountable to its success. Tight timelines though created a sense of urgency, it did not give on the workers the time to meaningfully implement the policies and fulfill on their duties.

Multi-Science Approach

Researcher Ogawa (1995) suggested that science itself needs to be reimagined and the notion of 'science for all' is Western science for all concept, instead of one of several science styles. As a result, he introduced the 'multi-science' methodology where science is defined as a rational explanation of the physical world. This was 'relative to the community of scientists who produced its knowledge' (Ogawa, 1995, p. 585). It was seen recreated within every society. While Western science is one approach, which is situated in the community that created it. Indigenous science is another method existing in multiple forms and supported by a specific cultural group, not by a specific individual' (Ogawa, 1995). Ogawa contended that each culture's attitude to science brings with it not only a body of information, but a particular method, or idea of rationalism. Simultaneously, a student's personal experience was based on a specific worldview, affected by their own indigenous background, religion, level of development, and many other factors. Western, indigenous, and personal science jointly created a 'multi-science view.'

Science researchers concluded the culturally competent educators have access to large cultural base of information and resources their students carry into the classroom is essential to engage them (Darling-Hammond et al., 2020). This attitude helped them recognize their pupils' needs and increased their inclination to sees learners as extensive wealth of knowledge. This perspective contrasted the damaging view standardized assessments place on minority students. When students' culture was seen as assets rather than deficits in learning science, the teachers can then use them as assess points to other related material while sparking interest (Brown, 2005; Gee, 1989, 2004).

Liberation Paradigm

Looking at the current education system of who and how mathematics was taught. Most often, it was taught by White teachers. It sent a message to Black students that they have no part in the creation of mathematics and its best use in our current system as a means to attain a high-paying job. This was Eurocentric view that has been part of the discourse and benefits White interests while disadvantages Blacks (Davis, 2018). In order to impact Black students, adopted a paradigm starts with teaching them with their community in mind. To think for the Black collective looked like "what is it that I am learning and how can I use it to free and empower my community." Settled for just passing a test is insufficient for progression. Blacks also must be taught how to use science to enable access for themselves and their people. The dominant method of teaching STEM (mis)represented and blocked out for centuries the vital contributions of Black people from Africa and the U.S. The U.S. had not made significant attempts to integrate Black impact and influence in STEM on a national level. As the status quo continued, overt assertions that Greece was the origin of mathematics, European and North American successors further advanced it (Anderson, 1990). Furthermore, Anderson suggested that

> The dominant curriculum in use today throughout the United States is explicit in asserting that mathematics originated among men in Greece and was further developed by European men and their North American descendants. From generation to generation for centuries this type of Eurocentric "scholarship" has been reproduced in the objective and subjective pursuits of justifying racism (pp. 349–350).

For centuries, the status quo relied on the continued distortion of Blacks and their test performances (Lee, 2019). Even though, initiative roll outs aimed to curb the widen gap and the comparison of Blacks to other culture groups made little progress. What has been missing was the nationwide attempt to include as well as educate the public of the influences and impacts the

Black Diaspora had on American and global society.

Such reformation included taking on a role of dismantling the systematic indoctrinating of policy that tended to turn off Black students (Brittain & Kozlak, 2007). Using mathematics as an example, according to Davis (2018), the paradigm shift led by critical Black scholars who seek to challenge the deficit discourse, substandard teaching of mathematics and neglect of Blacks in mathematics education among other things (Anderson, 2017; Davis, 2018). Furthermore, using the test scores and grades of White students as the standard for Black student success and high achievement were measured promotes individualistic interest that emulated a Eurocentric model, as well as imitated a Whiteness criterion and a privileged view of mathematics (Schenke et al., 2017; Schiele, 2002). While the exclusion of Black community continued, the gap widened. This paradigm called for Blacks to comprehend their responsibility in the utilization of mathematics and therefore advocated for self-sufficiency for the community. A mindset based black history, culture, and interests was central to meeting the Liberatory paradigm as it responded to the distinct need of the community over the individual.

Researchers Martin and McGee (2009) contended, “Any relevant framing of mathematics education for African Americans must address both the historical oppression that they face and the social realities that they continue to face in contemporary times” (p. 210). To have success with Black students, they must know about the contributions of their ancestors to the mathematic field, for example. How its utilization formed great civilizations, specifically the first highly technological civilization known to humankind on the continent of Africa (Davis, 2018). This study contended students must see Blacks in all sectors in STEM, especially in science. The present and historical view of Black people made it an unwise choice to choose a field where it is not only exclusive but that places getting a high paying job above all because they see the value

of a cooperative economics agenda versus a singular and capitalistic agenda (Escobar, 2016; Gladden-Young, 2020). Perhaps the biggest difference between a Eurocentric paradigm and a Liberatory paradigm was that the former can produce successful Black students in mathematics who go on to be good employees, but the latter produced Black students who were and sources of community advancement and foundation development therefore agents of transformation (Davis, 2018).

Summary

Traditionally, STEM had been the domain of White males. Such barriers became a chief focus of research impacting women, and underrepresented minorities. Ways to overcome the barriers included revising and changing STEM pedagogy to increase accessibility and breaking down the hidden agendas which define the culture of STEM. Not enough research geared to supporting Black progress in STEM education or the encouragement systemic reform in STEM fields.

Mostly comparing Blacks to their White counterparts to access achievement as Whites implicitly and explicitly were the standard. Any data to support this two-tiered achievement is supplemented by the test scores of standardized assessments. However, some progress appeared to occur in pocket areas across the country and at a slow pace. Teaching these students in a fashion that acknowledged their lineages as well as contributors to the breadth of knowledge of STEM gained traction again in progressive districts across the United States. Though some researchers took an anthropological approach to STEM (science education, specifically), they tended to come from outside of the United States and discussed the impact of teaching indigenous people western science instead of their native science. No outright acknowledgement of the effect western science had on Black students and how their marginalization impacted their

participation in STEM. Instead focus was on achievement gaps or underperformance continuously characterizes this subgroup. Ignoring the power, it had to know the contributions of their ancestry and possible connections that could be made in designing science materials where culture was included. Black students were continually robbed of such links.

Culturally, Blacks pursued fields that promote and support their community. Psychology, sociology, human resources, and the arts are diverse and receptive disciplines. Traditionally, STEM fields are not promoted as supportive areas and seen more hostile than responsive. The lack of diversity created an exclusive climate. Therefore, the pursuit also relied on parent involvement, how it depended on varies based on means or lack of resources. The best place for any child to thrive was where their support resides. Even in school sites, as an afterthought, Black parents were not notified of the new civil liberties and court rulings attempted to remediate glaring inequities. Thus, they unable to access the very resources that propelled the school and their pupils forward met their educational goals. The misalignment continued and frustration succeeded.

However, the benefits of Blacks pursuing STEM had lasting ripples in both the Black communities and society at large. Many cultural wins made by Blacks have led the way for other POCs to benefit. Parents and students started to place their trust in an institution that fulfilled on their school or district mission. In addition, preparing students with 21st century skills (critical thinking, collaboration, creativity to name a few) satisfied the promises made for generations by both the government and schools across the nation (Tarbutton, 2018). Such skills also encouraged and necessary to thrive in STEM. Though seen as difficult, STEM coursework was not out of reach as long as encouraging success in Black students was integrated in pedagogy and Black cultural contributions are ubiquitous. All students especially Black students needed to

know the how Blacks contributed to STEM, and it was not out of the norm to see themselves as scientists. Just as it was no longer out of the norm to have a Black President or Vice-President of the United States, because to two generations grown up experiencing it.

The impact of not sustaining Black contribution slowed down overall progress especially when many of their inventions and discoveries influence our daily lives. They were used as applications, fostered more scientific discoveries that propelled humankind to the moon and beyond (UC Berkeley, 2019). The depletion of technical personnel keeps unsolvable issues unsolved and delay advancement while perpetuating a false narrative of Blacks inability to thrive in STEM. When Black students connected and given a platform, they advocated for the equity and demanded for culturally relevant education. Keeping their contributions hidden also held the next generation from succeeding and propagated an underclass. Their intellectual inheritance cannot be used to leverage a better society. Regression ensued, and stereotypical threats spread stifle any possible glimmer of progress. The goal of global economy prowess in the U.S. becomes a distant memory.

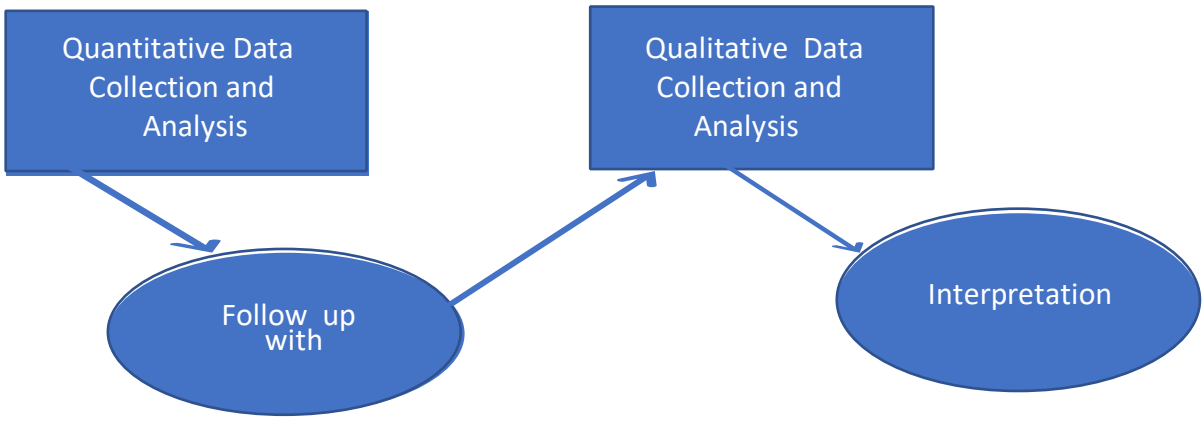
CHAPTER 3: METHODOLOGY

Research Design and Rationale

This study explored the possible barriers students interested in STEM had experienced when pursuing STEM classes. This research concentrated on Black students' experiences compared to their non-Black counterparts in a high school setting. The study expanded on the equity theory of Adams (1965) to the equity sensitivity theory of Huseman et al. (1985), the self-determination theory of Deci and Ryan (1985), and the grit theory of Duckworth et al. (2007). This research utilized a mixed-method explanatory sequential design that articulated collecting and analyzing quantitative data then the qualitative data in two consecutive phases within one study. Below is a graphical representation outlining the procedure in this mixed-method study.

Figure 3.1

Explanatory Sequential Design



Adapted from Creswell & Plano Clark, 2011, p. 69

This research built on quantitative and qualitative data demonstrating challenges Black students experience. The research entailed surveying high school students then delineate the ones with STEM interests and examined the commonalities of their experience that could be attributed

to any successes and pursuits in STEM classes or STEM pursuits. The next broad steps shared and educated the change makers in schools and districts.

Setting and Participants

The participants for this study were composed of senior high school juniors and seniors. Located in the heart of Los Angeles, the research focused on one comprehensive high school. The school had three small learning communities and two magnet centers on the campus. One magnet was over 25 years old and well established with a visual arts theme. The other magnet center was in its second year and with a total of two grade levels. Each learning community (including magnet centers) served a diverse student population of over 350 pupils, except for the new magnet center with under 200 students.

The study focused on surveying senior high school juniors and seniors. This cohort was ideally suited because of the time spent on campus and more extended interaction with teachers, counselors, and other staff. Their input helped shed light on low participation in STEM class enrollment.

Sampling Procedures

The researcher had a colleague to administer the survey as recommended by the school district. The colleague will not be an administrator. The surveyor received the questionnaire link for Google Forms with none of the researcher's identifiable information. The surveyor then posted in their learning management system (LMS) for students to access before the school day and after school. Administering this survey took no instructional time. It used a snowball type invitation. Flyer-like notices were posted to invite participation (Appendix F). There were about 700 eleventh and twelfth-grade students available to study. The researcher understood that not all students will participate. Therefore, the goal was to have 100-200 respondents to the survey with

a 50/50 split of male & female. The anticipated distribution, in terms of race/ethnicity, was based on the ethnic breakdown of the school, which are African American/Black 15%, Asian 15%, Filipino 4% Latinx 58%, White 7%, Two or more races 1% (Ed Data, 2020). Therefore, about 8 Black students responded, and this was the next sample group. Research respondents completed the surveys in approximately 15-20 minutes via an online platform.

Students indicated whether they wish we contact them to participate in a follow-up interview by selecting yes and entering their electronic mail address to be contacted. The surveyor provided the list of email addresses of those students who agree to participate in the second part of the study. The data is protected (locked and secured). Data kept secured and destroyed after three years. Some students may feel very uncomfortable discussing why representation matters to them. Therefore, students will have the right to withdraw from the study at any time without penalty. If students feel uncomfortable talking about this subject, they will be referred to the school psychologist, if desired.

According to Etikan et al. (2015), snowball sampling involved leading methodical research and qualitative research with a specific relatively small group that was difficult to pinpoint or locate. This referral approach was applicable when the study focused on a sensitive topic or an overlooked issue (Kirchherr & Charles, 2018). Therefore, it worked well with phenomenological theory strategies due to its reliance on creating an approach reflected on the outlooks of those participating in the research tests of the interested population. The measures for the potential test group included the next following criteria. They (1) attended secondary, or senior high school (2) currently in 11th and 12th grade (3) completed two science courses or considered enrolled in a science course by one or more of three indicators—(a) graduation requirement, or (b) less demanding course, and (c) college requirement. The next test group had

(1) identify as Black or African American and (2) attend secondary, or senior high school (3) currently is in 11th and 12th grade and (4) completed two science courses or considered enrolled in a science course. The student's enrollment in the science class fell within one or more of three indicators—(a) graduation requirement, or (b) less demanding course, and (c) college requirement. The snowball sampling method led the researcher to gather information in the least restrictive manner for this initial survey. The research took distinct steps methodically to increase adequate representation. The researcher consistently reassessed the previous data collected and analyzed it after each completed measure.

Reviewed the responses from the respondents' multiple perspectives, then zeroed in on 11th and 12th grade Black students' responses, informed the interview questions for the second part of the study. The items needed amending or additional questions required to have a complete picture of the respondents' views. This type of sampling helped produce a phenomenological theory by reinforcing the study's thoroughness as it connected to the data collection and analysis steps to the second participant test group. These participants added to the theory's opening and axial coding (Creswell & Poth, 2018).

Instrumentation and Measures

Student Responsive Inventory

The Student Responsive Inventory (SRI) purpose was to gather students' perceptions regarding STEM while attending a Californian Senior high school. This inventory collected data relating to student involvement and participation in STEM courses as it is the initial survey given to all available 11th and 12th-grade students. The purpose was to learn why Black students are not taking these courses.

The researcher and her dissertation committee members designed the questions to meet the needs of this study. There were five options on the Likert-type scale: (1) Strongly Disagree, (2) Disagree, (3) Agree, (4) Mostly Agree, and (5) Strongly Agree. Open-ended questions inquired further about their participation in STEM courses or lack thereof included. Open-ended questions granted the researcher the chance to collect a qualitative response of students' views regarding their STEM coursework participation at school. The rankings selected provide the participants with a reasonable measure of their perspectives. The answers were confidential. The Student Responsiveness Inventory consisted of items addressing the student's perceptions and their affinity to STEM. The SRI began with five demographic questions about age, grade, race/ethnicity, and gender. The survey questions gauged the respondents' level of likeness to STEM activities outside of the classroom and their intention of pursuing STEM as a major or career. The theoretical framework helped guide the various questions, and some questions speak to each theory, therefore, incorporated in the survey. The survey questions were shared with other teachers to gain insight and reflect on what will be measured to ensure the items are valid, reliable, and answers the research questions.

Surveying was the quantitative method used to identify and establish baselines. Its purpose is to have a more general understanding of the problem. The questionnaire responses and semi-structured interview responses were the primary sources of data used in the data collection for this research study. The questionnaire possessed no identifiable information of the researcher. Therefore, the researcher did not be administering the questionnaire. A colleague of the researcher, who was not an administrator, will administered the survey as recommended by the school district. There was no expectation of conflict or opportunities to impact surveying administration because the researcher teaches ninth and ten graders, and the survey geared to

11th and 12-grade students. The surveyor provided an online survey link for Google Forms with none of the researcher's identifiable information. Then, it gave to students before the school day and after school as well. Participation was expected through word of mouth as it was a snowball type invitation. Also, online posting of the invite encouraged interest (Appendix F). The questions were completed in one session and submitted on the same day. Research respondents completed the surveys in approximately 15-20 minutes.

Interviews

After the survey data are collected, scheduling for the interviews took place. The surveyor provided the list of students who agreed to participate in the second part of the study. The researcher conducted semi-structured interviews with interested/willing Black participants regarding STEM interest and literacy questions. The researcher based follow-up the interview questions on the responses from the surveys. She anticipated that seven to ten participants were interviewed with a 50/50 split, then depending on how many participants responded to the study. The list of email addresses had the demographic information where the respondent must be 11th or 12th-grade students, African American/Black, and had taken three or more STEM classes. The interviews were conducted semi-formally, with a virtual face-to-face meeting with the participant and researcher through an online video conference platform. The qualitative method used was audio recording interviews of the participants to gain insight into the student's perspective of the STEM class experience(s). The researcher provided privacy as an opportunity for participants to speak freely. Interviews ranged from 20-30 minutes per participant. The school principal approved all recruitment and data collection.

Reliability

Using a reliable and quality recording device increased the reliability factor of the study. The researcher coded the results beginning with a more substantial group of descriptors like STEM Support and programs and funneling down to supports based on gender and ethnicity to Black students and other related subcategories to STEM. The use of multiple coders like participating in an intercoder agreement created a system where the study is seen as reliable. Established a common platform for coding and developing a preliminary code list, then developing a shared codebook, applied the codes to the collected data for comparison, and finally assessed and reported the intercoder agreement among the researchers (Creswell & Poth, 2018).

Validity

There appeared to be a difference in support regarding Black student participation in STEM courses and the availability of STEM courses. Therefore, equity sensitivity as a construct showed a range of equity, self-esteem, input-output orientation, work satisfaction, and justice (Patrick & Jackson, 1991). These factors connected to the students' experience regarding their access to STEM classes or whether anyone fostered their STEM interests. Using this construct provided possible answers to why the gap, as mentioned earlier, exists. Based on the research, this gap appeared to be one of the largest contributing factors to the lack of STEM fields (Ouimet, 2015). Some studies examined this point, which is all the more reason to focus on it in this study (Bauer-Wolf, 2019; Funk & Parker, 2018; Riegle-Crumb & King, 2010).

A few measures used to support this construct validity. Several studies corroborated the following: GRIT short scale, self-determination theory scale, and equity sensitivity scales. Similar questions from the above scales were used to create a new scale (SSR) and piloted in an online survey by the researcher. These results validated further by the previous studies' outcomes. The research also used the known-group method. This method included analyzing

answers from groups expected to differ in responses to the variables measured. The literature suggested in a predominantly Latinx school in an urban area, Asian pupils perceived the school climate differently and more positively than the slightly smaller Black population (Yost, 2018). A finding of such a difference provided additional support for the validity of the scale.

The validation strategies included the triangulation of the data using sources like surveys and notes taken from interviews. Reviewed artifacts from events for courting Black students to STEM programs like brochures, flyers, and parent invitations, then compared them to the available research. The researcher looked at how this study can be expanded from where it ends. Therefore, once the data was collected, we further explored evidence of corroboration and use these insights in our interpretation and writing (Creswell & Poth, 2018). The use of triangulation validated evidence from different sources to bring about viewpoints. The investigator also recognized the biases throughout the study and documenting them. The reader understood the perspective of the research and the reasons for taking a position or generated theory. Using member checking provided further validation of the interpreted results.

A pilot study administered helped the researcher hone-in the critical variables related to the theories used. The questions initially used were for engineering students, and the age-group taking the survey could not answer the questions accurately. Due to time constraints, the researcher needed a younger age group closer to the intended sample. The piloted questions also were challenged to respond and may have confused participants. Therefore, the items needed to be direct and straightforward. The next steps included aligning the inquiry with the study's purpose. It should either answer the research questions or test the construct. This pilot study was mostly qualitative. The survey had quantitative elements and informed qualitative factors, while the interview questions were qualitative. It also indicated that the theoretical framework and

research questions needed revisiting in addition to the survey questions. The updated pilot questions were a part of the SSR. They leaned into testing the construct to answer the research questions, and reformatting the items led to a more precise result.

The researcher based the survey questions on the following constructs: the continuum of fairness (equity sensitivity), autonomy, relatedness, and perseverance. The combination of this study's theories, literature review, and the pilot study solidified these constructs. It began to demonstrate what has been adopted by society concerning how societal view impacts Black students.

Data Collection

The interruption of the COVID-19 global pandemic halted in person interaction in schools. Therefore, the study had to be move to a virtual platform. The worldwide pandemic took longer than anyone anticipated. The researcher's plan converted from a hybrid model of online survey submissions and face to face interviewing to all virtual data collection.

The questionnaires and semi-structured interview responses were the primary sources used in the data collection for this research study. The research aimed to explain data collection to participants, provide an assent letter, and an informed consent form. Once both forms were approved by voluntary participants and their parent/guardian and submitted, the questionnaires will be accessible electronically and completed by research participants. Participants understood surveys are confidential and submitted via an online platform, Google Forms for participant completion. This procedure ensured confidentiality.

Students indicated whether they wish to participate in a follow-up interview by selecting yes and entering their electronic mail address to be contacted. The interviewer conducted face to face using a video conferencing platform with the subsample group. The researcher audio

recorded interviews and transcribed them independently.

The research protected the data (locked and secured). Data kept secured and destroyed after three years. Some participants may have felt very uncomfortable discussing why they see a lack of representation. Therefore, students had the right to withdraw from the study at any time without penalty. If students felt discomfort talking about this subject, the researcher will refer them to the school psychologist.

Data Analysis

The questionnaire was analyzed using descriptive statistics. The researcher used descriptive statistics to describe student perceptions to identify variables related to the research questions. She also determined the averages for how students responded to the survey. The researcher used descriptive statistics to understand the pattern of responses.

The qualitative sections were the open-ended responses from the survey and the interview responses. The investigator used comparative coding was used in the data analysis. The open-ended questions and semi-structured interview method gave standard data from participants while allowing flexibility to probe answers more profoundly and gather more information than is found in a structured interview (Gall et al., 1996). The researcher transcribed the interview and audio-record each interview to ensure the transcriptions are accurate.

The researcher took detailed notes of participants' responses to further the conversation about student perceptions. The researcher compared interview responses. Then categorized code, and triangulated interviewed answers. Themes for each research question was created and compared.

Ethical Issues

Investigators received consent to direct a study at a site must communicate to officials or an administrator how their inquiry will make the least interruption to the site's activities. Investigators should not misinform the study subjects regarding the general-purpose of how data will be used and shared. The interview process created a power imbalance through a hierarchical relationship between the researcher and the participant. This potential power imbalance needed to be respected, and building trust and avoiding leading questions helped remove some of this imbalance (Creswell & Poth, 2018). Keeping straight the multiple perspectives shared by subjects because of the study's longevity and the complexity of the issue studied but only presenting one perspective is also an issue. Sharing only the negatives or the positives of the data because the research sided with one of the subjects creates an incomplete picture. The data collection process was handled with care and reported all sides for the final data representation in Chapter 4

The researcher agreed to adhere to and follow the National Institute of Health (NIH) ethical codes and research regulations to assure minimum risk to research participants. Confidentiality is a priority. There were no conflict or opportunities to impact the surveying administration as the researcher teaches ninth and tenth graders, and the researcher designed the survey for 11th and 12th-grade students.

The researcher informed each participant of potential risks by participating in this study. The student was asked to sign a student assent form agreeing to his or her participation. There was no conflict or opportunities to impact surveying because the researcher teaches ninth and ten graders and gearing the survey to 11th and 12th-grade students. Data coded and numbers were assigned to all participants (surveyed and or

interviewed) to protect their identities. The researcher was the only individual with access to the participants' information. Data was securely stored off-site. The data destroyed after three years. The researcher agreed to conduct this study with integrity and to the best of her ability.

Summary

The Black student experience in high school potentially impacted post-secondary choices. The probable opportunities examined and barriers that influenced their STEM options guides this research. As possible, obstacles highlighted in this study, factors that contributed to and exacerbated discussed. The organized design structure of the study amassed quantitative evidence. Then qualitative information gathered and analyzed to assist in dissecting the underlying reasons for why STEM participation is low among Black students. Establishing this study in a school setting began to build the context. Such context added precision and directed the researcher's attention to a particular path of reasoning. The population of interest, Black students in the second part of the study was refined and created a practiced control method. It kept the researcher from digressing and made it easier for readers to understand. The desired population of 11th and 12th-grade Black students arose once the researcher realized who will help answer the research questions. Participation in the study was voluntary. Flyers were posted to invite participation.

Surveying a school site was not practical; however, selecting a portion of the student population to discover their viewpoints and perceptions was possible. High school students often took a short survey regarding trends on various social media platforms. Although intrinsically, they are helpful, taking scholarly surveys are unmotivated. Therefore, they can be a difficult population to reach, and Black students, in particular, tend to shy away from participation and a

more challenging community to get.

The surveyor shared the online survey with participants, followed by face-to-face interviews of a second test group via video conferencing. Recruiting specifically Black students for this group and invited with a survey question additional consent to be contacted via email and invited through word of mouth. The researcher based the survey, student response inventory (SRI) on existing scales, the researcher's questions, and the dissertation committee's input. The interview questions relied upon the responses from the surveys as this research was a phenomenological theory study. Reliable practices yielded dependable and consistent outcomes. This research used some methods to strengthen reliability like a sound recording device. These coding procedures funneled down from STEM support's broad topic to supports based on culture and race. The design and approach of this study took spoked its validity. Several studies supported the existing scales used. It also helped inform the creation of a new scale. The constructs: the continuum of fairness (equity sensitivity), autonomy, relatedness, and perseverance applied, illuminated the study's value, and represented the phenomenon intended to measure. The pilot study helped the researcher by indicating which questions were useful, redundant, or needed. It solidified the next steps and informed the direction to which the research moved.

CHAPTER 4: RESULTS

Introduction

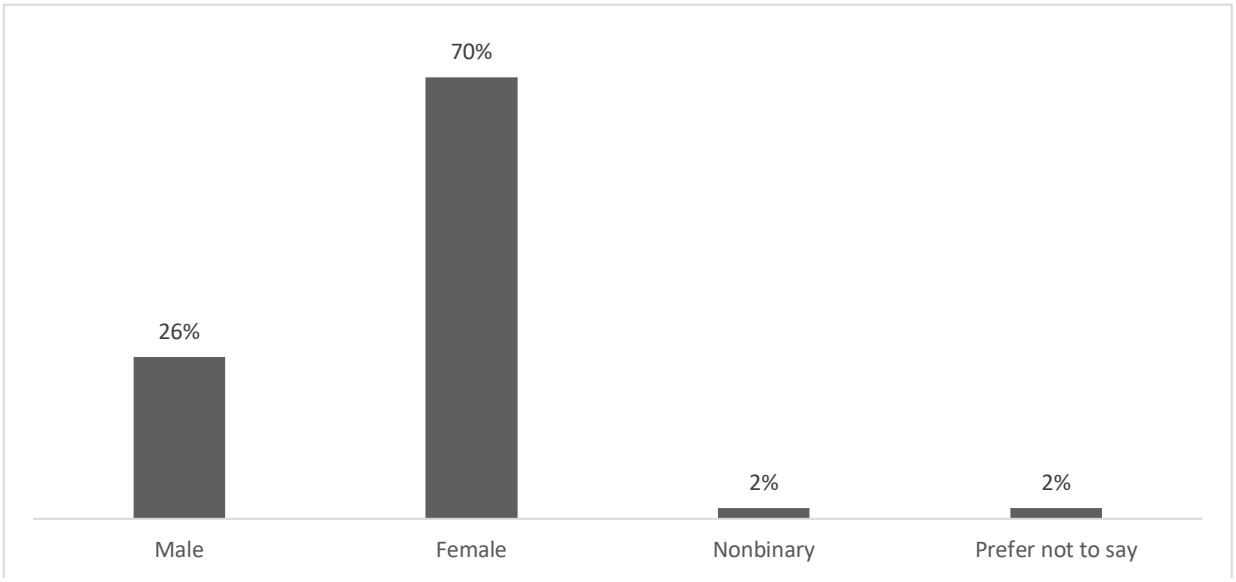
This research study aimed to explore the underrepresentation of Black students and the barriers they experience as they plan for postsecondary aspirations in STEM. The researcher chose to survey all students enrolled in STEM classes, since the number of the target population was very low at the school where the study took place. The intention was to highlight the demographics reflected in these classes and the possible reasons for continuing or discontinuing pursuits in STEM. This chapter showed the descriptive statistics of the sample. The quantitative and qualitative outcomes were organized with the guidance of the research questions.

Descriptive Statistics

The survey was made available to over 700 students on the learning management platform. There were 116 students who agreed to participate in this research. The demographic breakdown of the participants in the study were 70% female, 26% male, 2% nonbinary and the remaining 2% preferred not to say (Figure 4.1).

Figure 4.1

Gender Breakdown of Participants

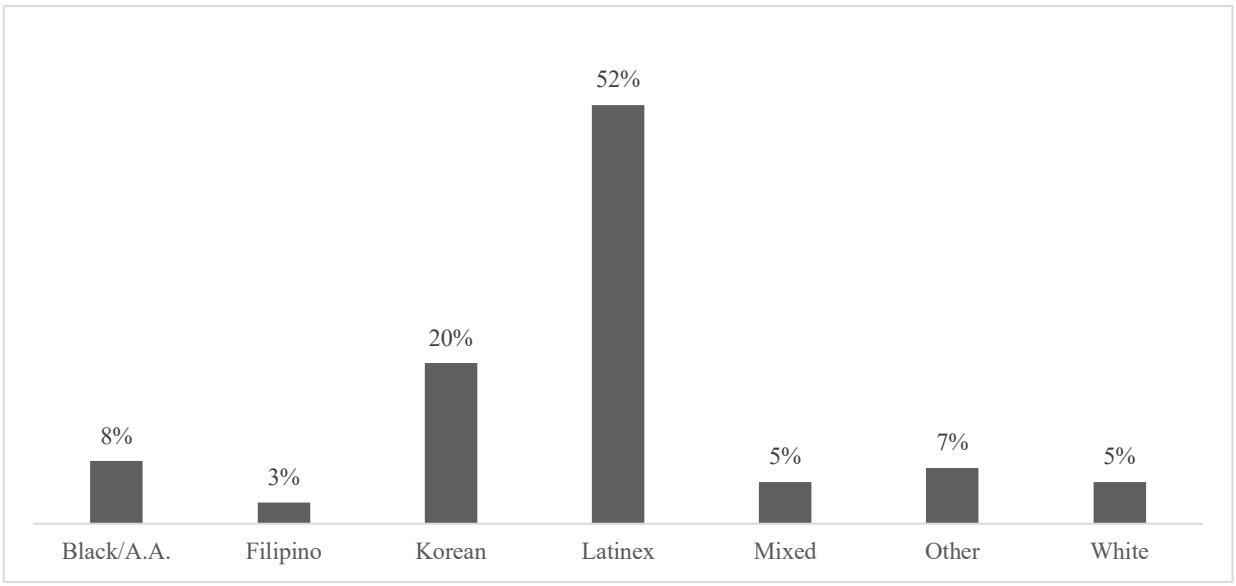


Note. n=116

Figure 4.2 presented the percentage of participants by ethnicity (*n*= 116). The ethnic make-up of the study was 8% Black/African American, 3% Filipino, 20% Korean, 52% Latinx, 5% Mixed, 7% Other and 5% White. As compared to the overall school demographics were 15 % African American/Black, 15% Asian, 4%, Filipino, 58% Latinx, 7% White, and1% Two or more races (Ed Data, 2020). According to the California Department of Education through the California Longitudinal Pupil Achievement Data System, CALPADS (2020), the racial/ethnicity diversity index that exist in this school has remained stable with 2019-2020 diversity index of 46. A high number indicates a proportional distribution (California Department of Education, 2019).

Figure 4.2

Ethnicity Breakdown of the Participants

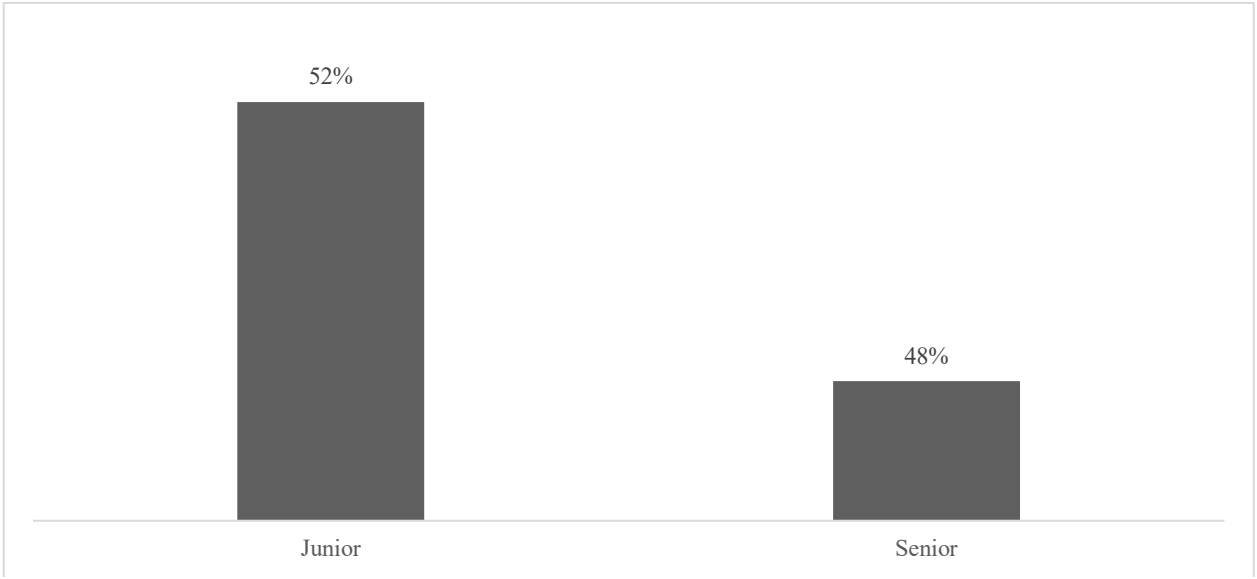


Note. N=116

The research focused on possible insight, years of attendance and experience as a group to study. The participation makeup consisted of all upper classmen. More than half of the participants were 11th grade students (52%) and remaining 48% were 12th grade students.

Figure 4.3

Participants Breakdown by Grade



Note. *N*=116

The available participants for this study consisted of a diverse population of students. It was, therefore, important to get their perspective regarding the survey questions. The researcher recognized the overall opinions of this group could add another layer of dimension since there was an 8% participation rate among this Black and African American subgroup. Each question reviewed had the whole group response from the participants then compared to the Black and African American students' responses.

Research Question 1

Why are Black students underrepresented in high school STEM classes?

The Table 4.1 showed the collective participants' enrollment percentages in STEM classes. Approximately, 81% of the students reported taking a math course and 64% indicated taking a science course. While 35% of participants responded No for taking a science elective, 18% also responded not being in a math class. The percentage of students not registered for a

technology and engineering course are 83% and 84% respectively. Less than 20% of the participants elected not to explore technology or engineering course offered. The data also showed a few students selected “Other” as a response and therefore included as an outlier in the data collection.

Of the 8% of Black and African Americans participated in this study, the researcher found that about 56% enrolled in science classes, about 11% enrolled in technology, 13% enrolled in engineering and 78% enrolled in mathematics.

Table 4.1

"I am currently taking STEM class."

Enrolled class	Science	Technology	Engineering	Math
Yes	64%	17%	16%	81%
No	35%	83%	84%	18%
Outlier	1%	0%	0%	1%

Note. N=116

As indicated in Table 4.2, 43% of the participants reported taking a science elective. About one-third of them took a science elective while a tenth took an advanced placement (AP) science course. More than half replied about taking a math elective course. Specifically, 39% enrolled a math elective and 17% reported taking an advance placement math course. Nearly 33% of the students answered not taking any of the available science classes offered and 4% did not respond. The data also showed that 7% were not taking a math course as 11% did not respond to this question. With regards to technology, 15% of the sample chose to take the classes offered and 11% of it were advance placement courses. About 61% of the students were not enrolled and 24% did not reply. Finally, 15% of the participants indicated taking an engineering course and 5% did not select engineering. The remainder 80% did not respond to the question of "What STEM class am I taking?"

Table 4.2

General STEM Class versus STEM Elective Class

Type of Class	Science	Technology	Engineering	Math
No Class	33%	61%	5%	7%
Regular	13%	0%	0%	26%
Elective	33%	4%	15%	39%
AP elective	10%	11%	0%	17%
Honor electives	7%	0%	0%	0%
No response	4%	24%	80%	11%

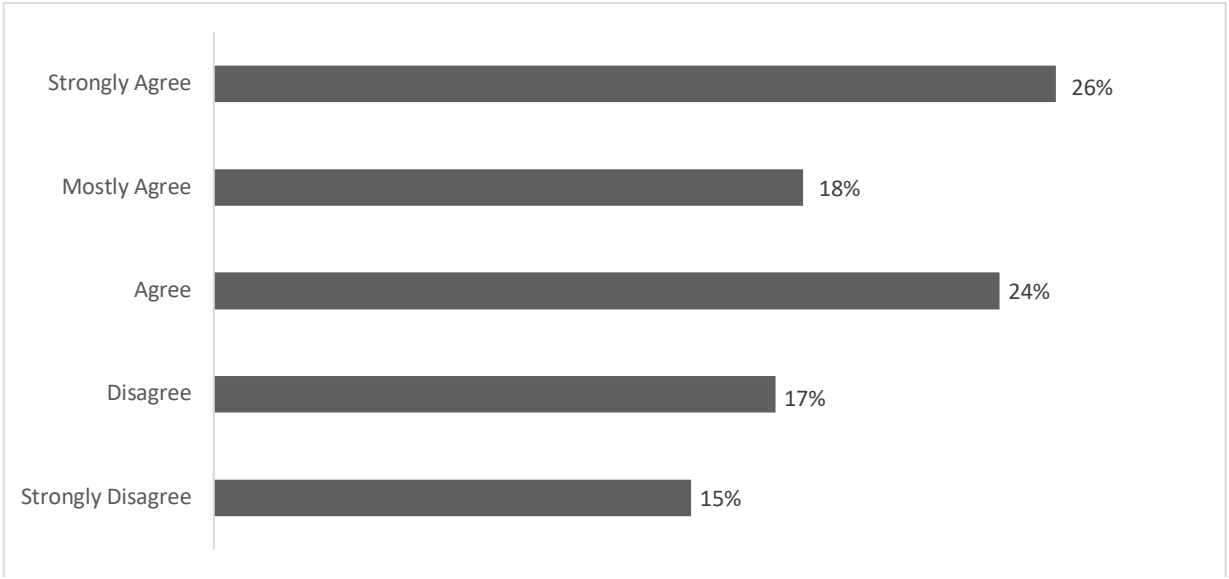
Note. Zeros represent question not applicable

Thirty-two percent of the participants disagreed with the statement; I feel all students are equally represented in STEM classes (see Figure 4.4). One participant commented, "I feel that students of color (excluding Asian students) are often underrepresented in STEM classes due to a lack of encouragement from teachers, not enough representation in media, and just the fact that STEM courses are often intimidating and exclusive. On the topic of representation, I feel like steps can be made towards encouraging female students to sign up for STEM courses." Although, 24% of participants agreed with the statement, reasons presented in agreement contradict the previous question. For example, another participant answered,

> I don't agree because there is not a lot of students of Black or Latino heritage in those classes which consist of primarily Asian and White students. I think the reason for this is because it's never really enforced within those communities and especially with our parents never really getting a college education because of whatever reason they never really know what we want to do all they really know is that we have to go to college and be successful, so we usually end up going through different paths.

Figure 4. 4

"I feel all students are equally represented in STEM classes."



Note. N=116

Table 4.3 gave the breakdown of the science courses taken by the participants. It showed 36% of the students were not taking science classes. The next highest percentage of students taking science was the General Physics class at 21%. The two advanced placement physics classes offered AP Physics 1 and AP Physics C were represented with 3% and 2% respectively. General Chemistry was strongly suggested class to be taken as it is one of the required courses to apply for admission in the California State University system. The Table showed 11% participation among the participants. While 6% were taking Honors Chemistry and 4% were in advanced placement Chemistry class. The upper division biological sciences showed a percentage of 8% for Marine Biology and 3% in Honors Physiology class.

Table 4.3

Science Courses Taken by Participants.

Discipline	Frequency	Percentage
Not taken	42	36
Chemistry	13	11
H Chemistry	7	6
AP Chemistry	5	4
Marine Biology	9	8
H Physiology	4	3
Physics	24	21
AP Physics 1	4	3
AP Physics C	2	2
Biology	2	2
AP Biology	2	2
H Biology	1	1
ICS	1	1

Note. N=116

Most of the participants were enrolled in a chemistry course whether it was chemistry, honors chemistry, or AP chemistry. Out of all the available advance placements, participants in this study enrolled in AP Chemistry. Fifty-six percent of the Black/African American students registered in chemistry course only. Three participants in the Black/African American subgroup did not indicate their enrollment status.

Table 4.4

Science Courses Taken by Ethnicity.

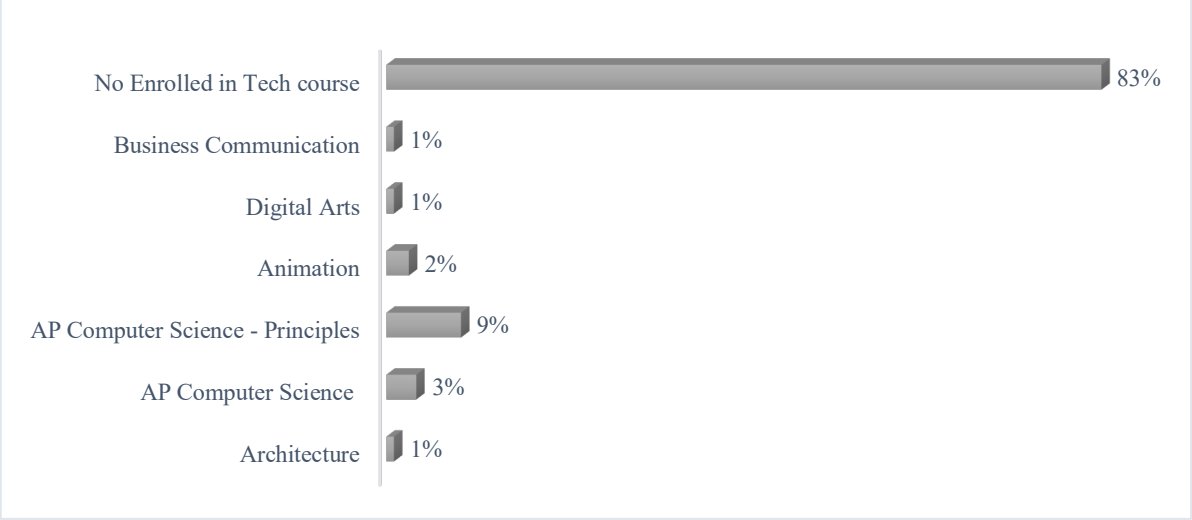
Courses	Black/AA	Filipino	Korean	Latinx	Mixed	Other	White
Chemistry	2	2	8	15	2	1	1
Honors Chemistry	3	0	7	8	0	1	1
AP Chemistry	0	0	3	11	4	5	2
Marine Biology	0	0	2	2	0	0	0
Physiology	0	0	0	0	0	0	0
Physics	0	0	0	0	0	0	0
AP Physics 1	0	0	0	0	0	0	0
AP Physics C	0	0	0	0	0	0	0
Biology	0	0	0	0	0	0	0
AP Biology	0	0	0	0	0	0	0
Honors Biology	0	0	0	0	0	0	0
ICS	0	0	0	0	0	0	0
Not Enrolled	1	0	3	24	1	2	2

Note. n=113 Two students did not respond

Figure 4.5 shows the percentage breakdown based on the technical courses available. Nearly 83% of the respondents indicated that they were not enrolled in a technology course. The two computer science classes made up 12% of the response and are designated as advance placement courses. About 2% of the participants showed an interest in the animation course. Architecture and digital arts courses each made about 1% each. The graph included Business communication as a response as it is considered a technical course in this school district.

Figure 4.5

Participation Rate of Tech Courses Taken by Respondents.



Note. N=116

Participants shared their reasons for enrolling in their respective engineering courses. More than three-quarters did not respond to this question. For the 23% who responded, 8% took their course because it interested them. About 7% were enrolled to meet graduation measurements. The remaining 2% indicated that it as a means to prepare for college requirements.

Table 4.5

"Why are you taking this engineering course?"

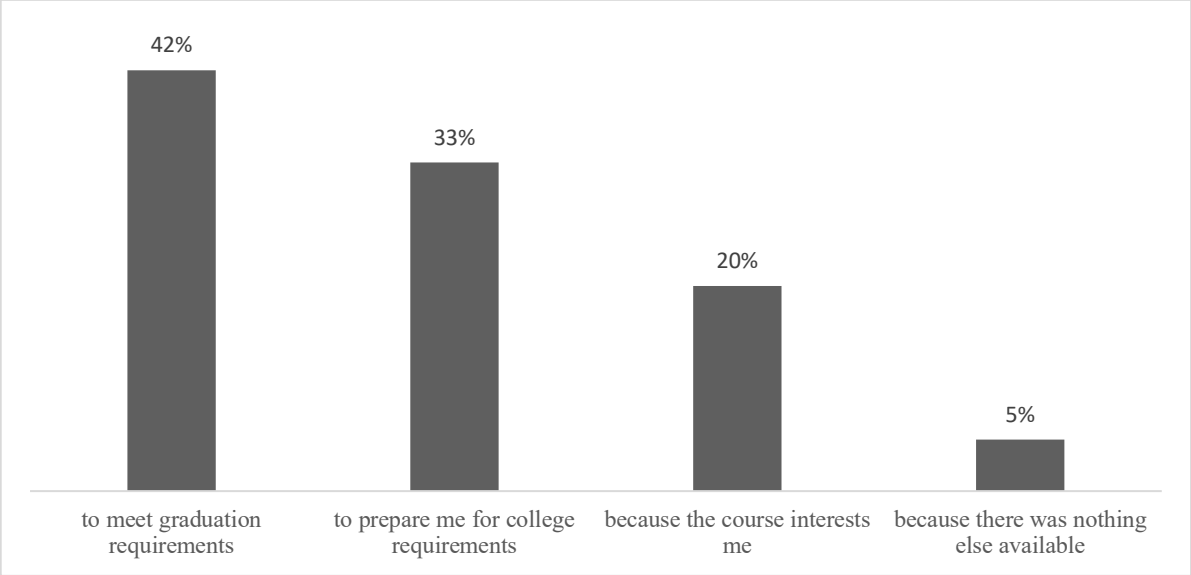
Reasons	Percentage
To meet graduation requirements	7%
To prepare me for college requirements	2%
Because the course interests me	8%
Because there was nothing else available	6%
Did not respond	77%

Note. N=116

Figure 4.6 depicted the reasons for taking the math course. For those who saw this course as a means to fulfill their graduation requirements, resulted in 42% of the responses. About a third recognized taking the math course to a way to assist in preparation for post-secondary success. There were 20% that took the course because they had an interest in it and 5% responded as they had no other course available for the take.

Figure 4.6

"Why am I taking math?"



Note. $N = 116$

Table 4.6 showed the summary of technology classes enrolled by ethnicity. AP Computer Science-Principles garnered 9% participation. The Korean subgroup had the highest number of students enrolled in this advance placement courses. Three participants in the Latinx subgroup were also enrolled in this AP Computer Science-Principles. The data indicated Korean participant participate in half of the number technical courses offered. The majority of respondents did not enroll in these courses.

Within Black/African American subgroup, the data reported one participant enrolled. No Black participants in the advance placement computer science courses offered. Over 87% did not participate in the available technology courses.

Table 4.6

Tech Courses Taken by Ethnicity.

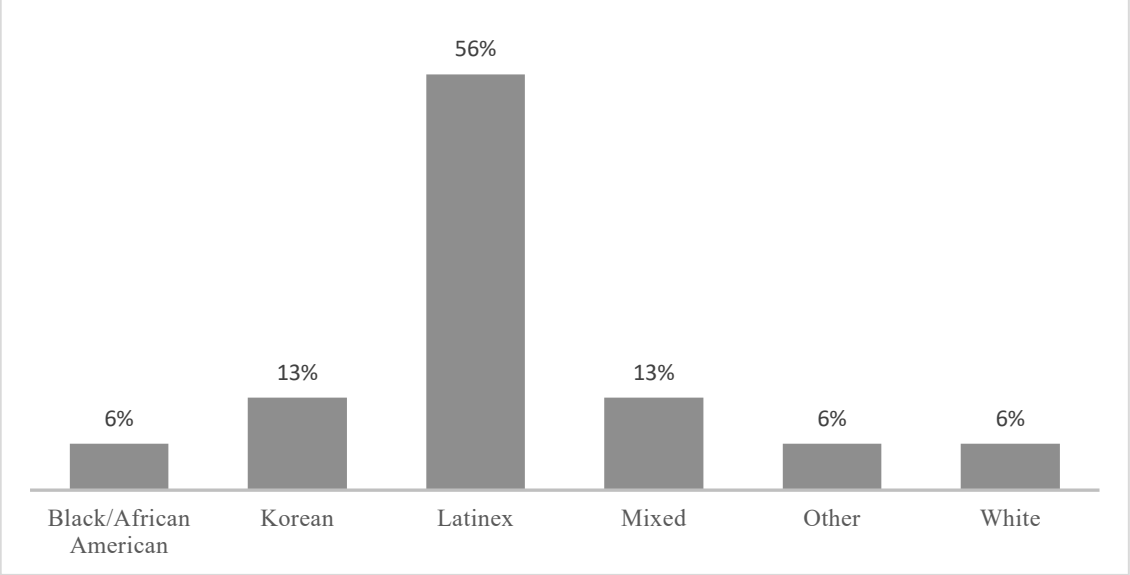
Courses	Black/AA	Filipino	Korean	Latinx	Mixed	Other	White	Overall
Architecture	0	0	0	1	0	1	0	1%
AP Com. Sci C	0	0	2	0	0	1	0	3%
AP Com Sci-Principles	0	1	5	3	0	1	0	9%
Animation	1	0	0	0	0	0	0	2%
Digital Arts	0	0	1	1	0	0	0	1%
No Enrolled in Tech course	8	2	14	52	7	4	7	83%

Note. N=116

Eighty six percent of the participants were not enrolled in the engineering courses. The remaining 14% were broken down by ethnicity. Latinx subgroup (56%) were the most enrolled, followed by Korean and Mixed subgroup at 13% and then other ethnic groups at 6%. The subgroup Filipino were not represented in these set of classes. Black/African American participants represented 6% of the enrolled group.

Figure 4.7

Participant Enrollment in Engineering Courses by Ethnicity

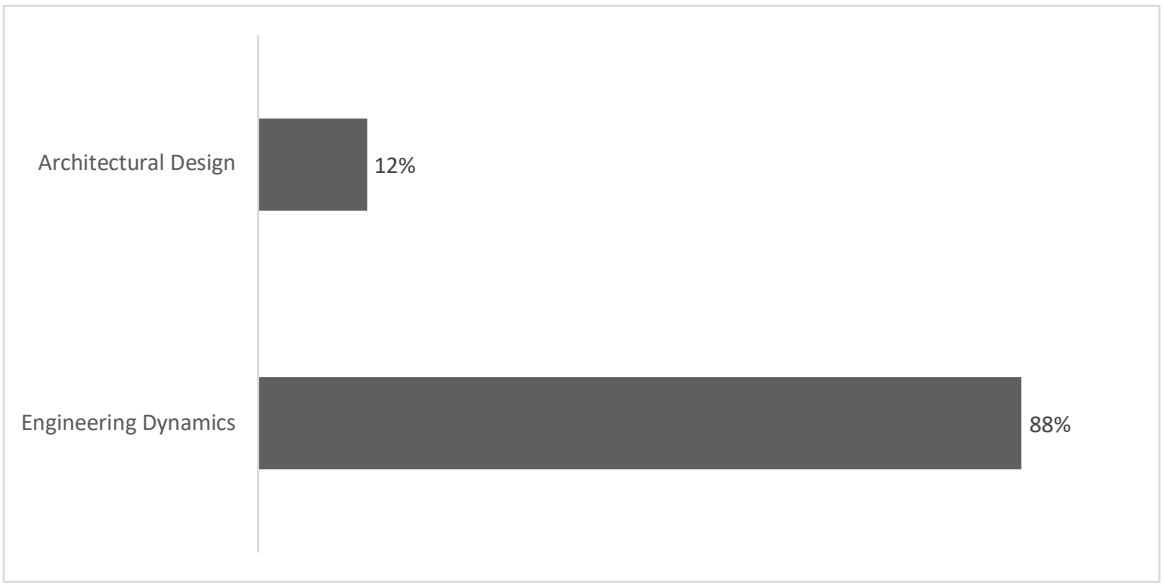


Note. n=17

Engineering Dynamics and Architectural Design were engineering courses offered (Figure 4.8). Overall, more participants enrolled in the Engineering Dynamics then Architectural Design at 88% to 12% respectively.

Figure 4.8

Engineering Course Participation

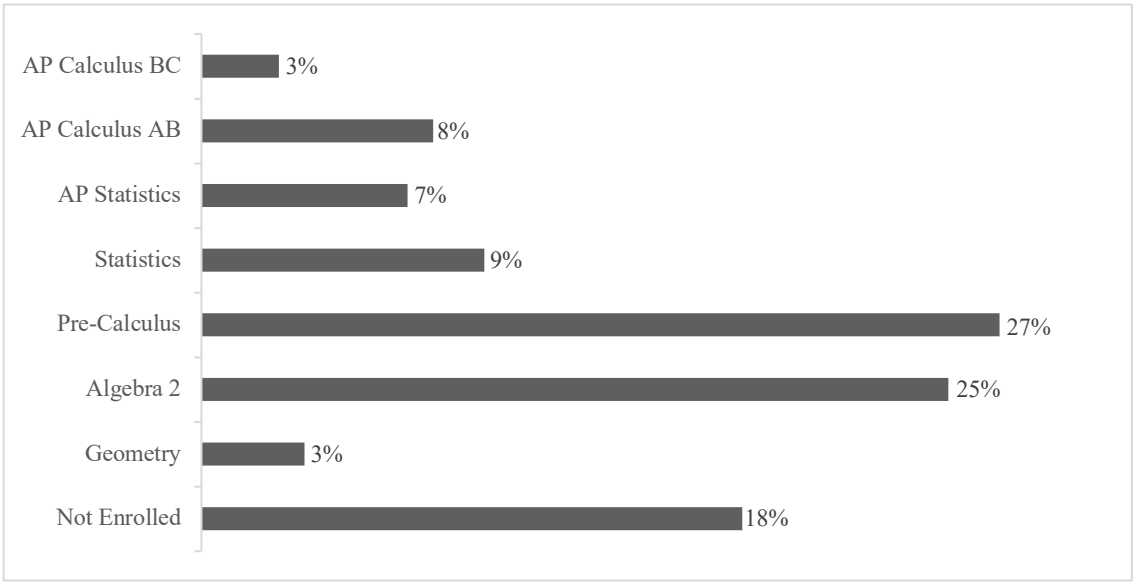


Note. n=17

Respondents were taking a math course at a rate of 82%. Though, 18% were not enrolled in a math class, the advance placement classes made up 18% of the participation. Over 50% of the students took grade level math. Three percent of the group were taking Geometry while most were taking either Algebra 2 and Pre-Calculus at 25% and 27% respectively.

Figure 4.9 1.

Math Enrollment by Classes



Note. N=116

The subgroup that exhibited participation in the advance placement math courses were Korean. The Latinx subgroup were mostly enrolled in Pre-Calculus and Algebra 2 (grade-level math). All of the students in the White subgroup were taking a math class. According to the data, no Black/African American students in this study were enrolled in any of the offered advance placement math classes. Their participation showed enrollment in grade level math. Approximately one-third did not stipulate which math class they attended while two-thirds of the interviewees shared their last math class.

According to the interviewees, lack of encouragement or recruitment played a factor in the underrepresentation of Black student in STEM classes. They shared that Black students may be interested in other fields. And lastly, STEM classes were regarded as challenging and with no support like a friend the motivation is not present (Table 4.8).

Table 4.7

Mathematics Courses Taken by Ethnicity.

Course	Black/AA	Filipino	Korean	Latinx	Mixed	Other	White
AP Calculus BC	0	0	2	0	0	0	1
AP Calculus AB	0	0	5	2	0	0	2
AP Statistics	0	1	2	2	1	2	0
Statistics	0	0	0	8	3	3	1
Pre-Calculus	1	1	8	14	3	3	1
Algebra 2	5	0	3	18	2	1	1
Geometry	0	0	2	1	0	0	1
Not Enrolled	0	1	2	14	0	1	0

Note. N=116

Research Question 2

What are the barriers inhibiting Blacks from enrolling in STEM courses?

From the sample, 74 participants commented on the various barriers they experienced when attempting to enroll in STEM courses at their secondary school. About 53% the students stated reasons around time as a barrier. These reasons included period and class conflicts, full classes, packed student schedule, classes not offered, not enough time and choosing to take the class the following year. Approximately, 23% of the students commented of being not informed, needing a signature, did not want to take AP my final year, wanted to take more science classes and not considered as hurdles causing their declined of interest in taking STEM courses. The next responses related to the various levels of requirements and difficulties with 16% and 8% respectively.

Table 4.8

"Why Are Black Students Underrepresented in High School STEM Classes?"

Interviewee Number	Responses
#001	"Yeah, we're not as important as, this White boy or this White girl, I guess it's just that mindset. And it's like, you still see it to this day. You see to this day, teachers, you see it a lot, coworkers, bosses, how they treat us people of color. It's sad, it's not fair. They say life isn't fair. Well, how can we, we never even experienced fair."
#002	"Well, because of history, how's it been. We were given poor education and stuff. And also I feel like we are different. We have different interests. I don't see a lot of black people in those categories."
#003	"The fear of failure I believe. You think you're going to fail, because that was difficult. So you feel like the next step is going to be even more difficult, and you're scared you're going to fail at it. So instead of pursuing it, you just don't it. I think that's it. Doubt."
#004	"For a lot of people because the teachers aren't usually like us. So it's not really an incentive to."
#005	"If you talk to somebody and they say, "I believe you have a lot of potential," it means a lot. And I feel like when someone sees a black kid, they don't think to go and tell them, "You could be something." If they see that they're not trying, a lot of people think, "Well, they don't care. I don't care."
#006	"I had a lot more AP classes. There were a few of us. Maybe three"
#007	"I hadn't really see a lot of African-Americans in the whole science related field because I guess sometimes they can feel like it could be a little difficult or I feel like they look too deep into it. Sometimes they think it's "Oh, I could never do that, it's science." And I feel like it's not as bad as they think it is. And I guess a lot of people, they just love to play it safe and things that they know they can do. And they just haven't had the right skills and the right resources to encourage them "Do this, you can do anything you want to do, whether it's life science, physical science, chemistry, anything like that." In order for that to happen more, I feel like we just need more people like you or more leaders in that field that look like us, that tell us "You can do this because I did it, so you can do it too."
#008	"I feel like a lot of the black students, either they don't know, or they don't think they're good enough to take those classes. Because it sounds scary, right?"

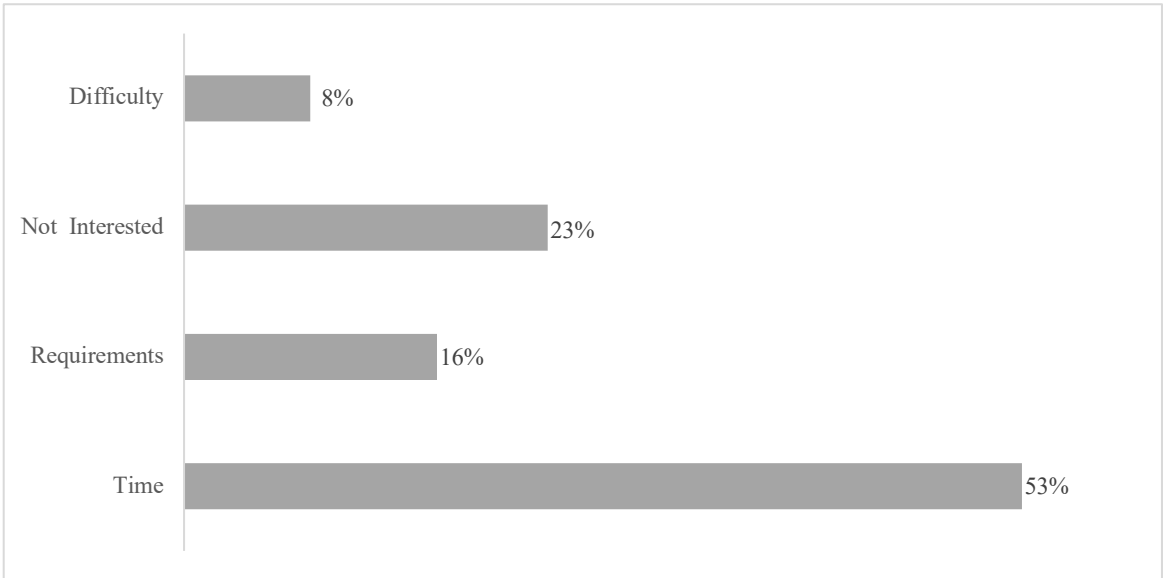
Note. N=8 Interview responses from subsample

Figure 4.10 stated the reasons for taking or not taking the available science classes. The primary reason indicated was time at 53% (39 participants). Followed by the lack of interest at 23% (17 participants). The category of Not Interest comprised of the following: not informed or not considered, did not want to take AP my final year, needed a signature. The next reason of requirements garnered 16% (12 participants) response rate. Difficulty was the last category and reason for enrollment in the science class at 8% (6 participants).

Over 55% of the Black respondents did not provide data regarding this inquiry. Of the 45% that responded, the reasons vary from not knowing why (20%), to being disinterested (20%) and meeting the required courses for graduation (60%).

Figure 4.10

Reasons for Taking or Not Taking Science Classes.

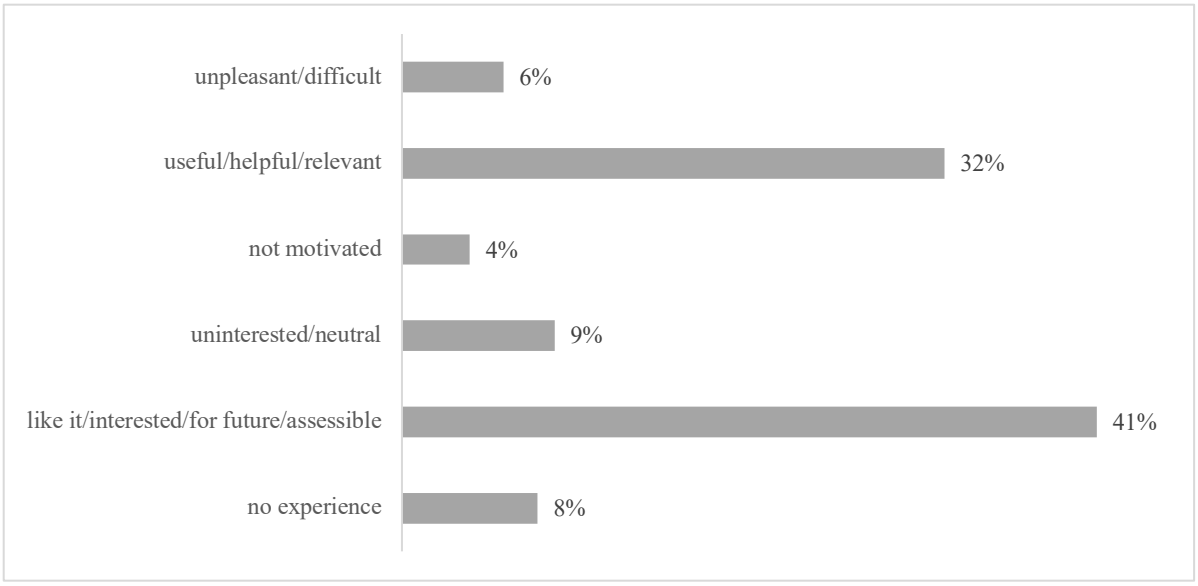


The data regarding the reasons for taking or not taking technology classes were as follows. About 41% of the participants expressed their affinity to taking their technology course at a rate of 41%. About 32% found it to be useful, helpful, or relevant. Some participants shared that they were not interested or indifferent to taking the class with 9%. Students made statements

related to their unfamiliarity with courses and or purpose of the course therefore 8% of participants had no experience. Approximately 6% of the participant found the courses unpleasant or difficult and 4% were unmotivated to take the available courses.

Figure 4.11

Reasons for Taking or Not Taking Technology Classes.



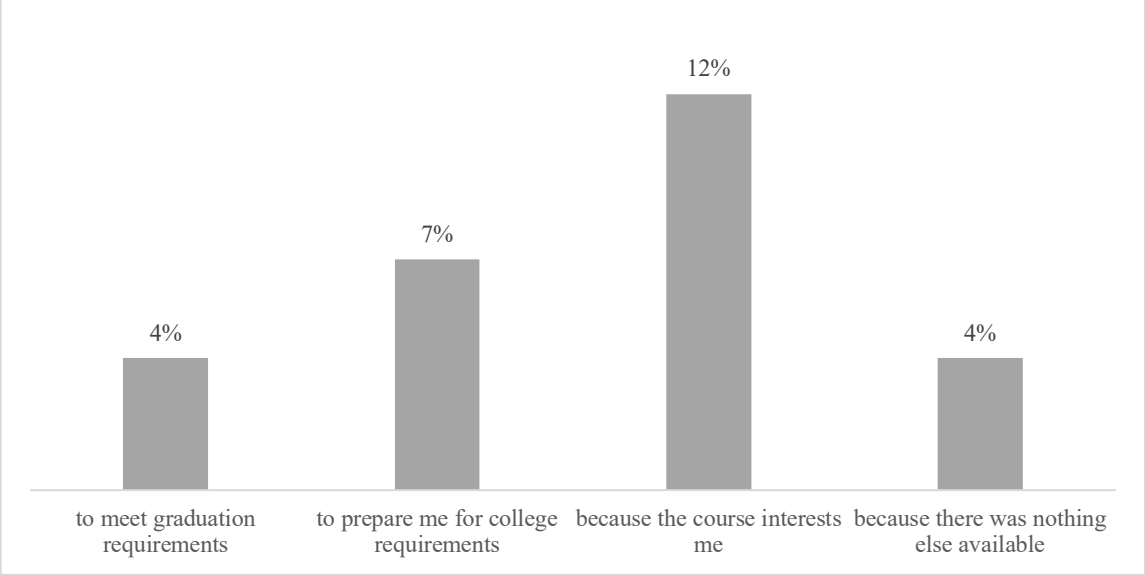
Note. N=116

With regards to the reasons for taking a particular technology class, 12% of the participants found it interesting while 7% saw it as means to prepare for college requirements. Meeting graduation requirements and having nothing else available to take both scored 4% each.

Most of the participants did not enroll in the technology courses. However, there were some participation. Twelve percent of the respondents participated in AP computer science courses. Business Communication was considered a technical class in this district course offerings. Therefore, it was included in the data and participant responded taking it. The data showed that out of the three participants in Animation class, one was Black/African American. The remaining subgroup members did not enroll.

Figure 4.12

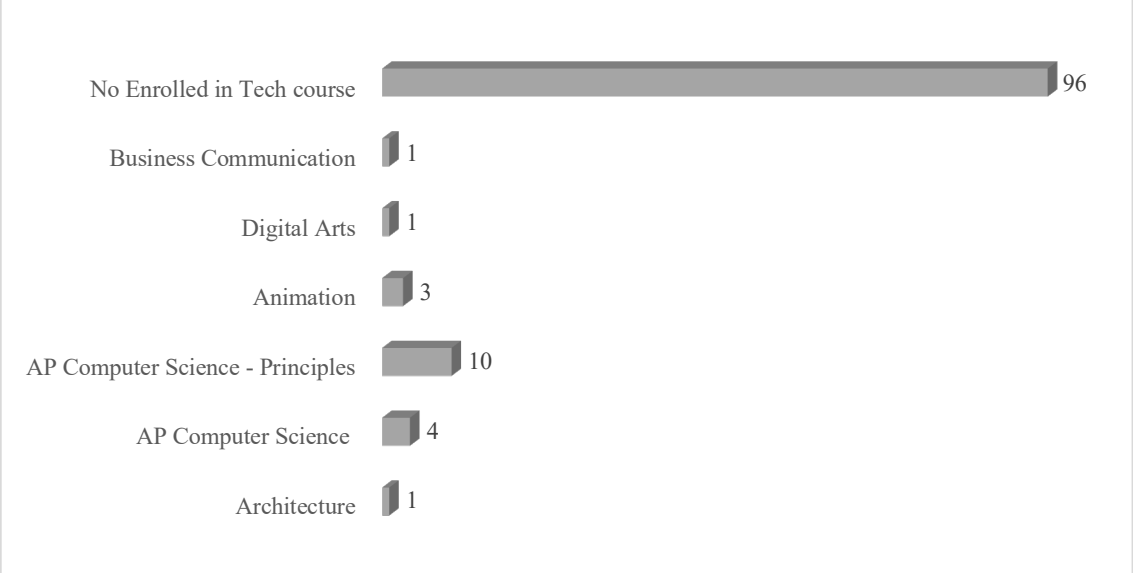
"Why I am Taking This Technology Class?"



Note. n=37

Figure 4.13

Technology Courses Taken vs. Non-enrollment.



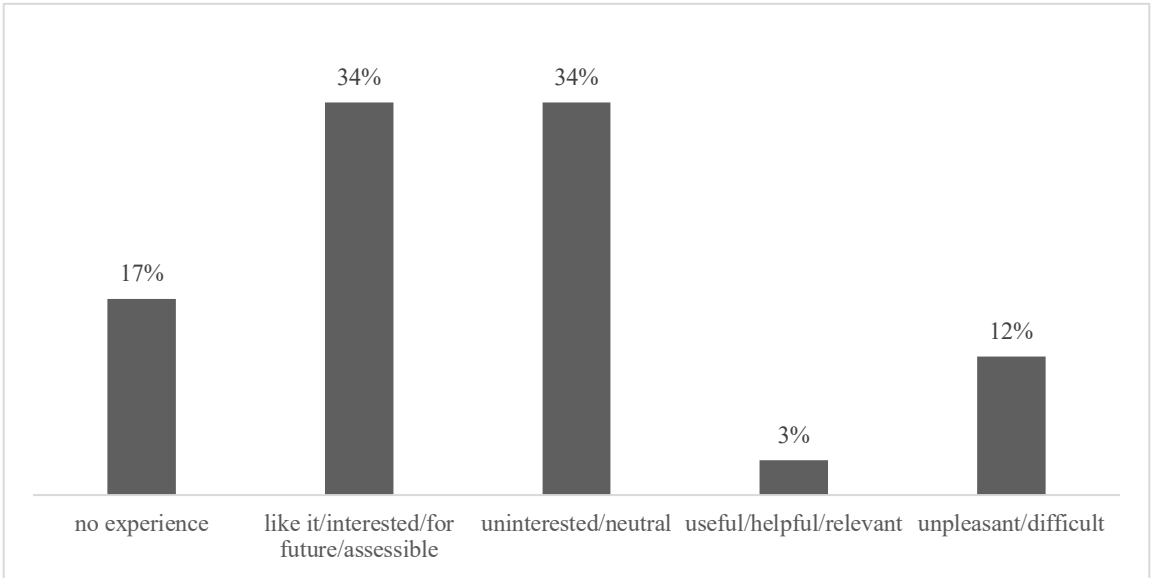
Note. N=116

In Figure 4.14, 17% expressed their non-experience regarding choosing the best science class. Thirty-four percent shared both their interest and disinterest concerning taking science courses. Three percent found science classes relevant while 12% found these classes unpleasant or difficult. Among the Black/African American subgroup seen the benefits, 44% did not respond and 22% either "no longer needed to STEM classes" or "already took engineering class" combined. One participant stated a barrier was "only for magnet program."

The data showed the breakdown of the Black/African American students experience regarding taking math courses. Forty-four percent of the students indicated feelings of unpleasant or difficult experience. Twenty-two shared uninterested and neutral regarding math and 22% liked math, finding it interesting. No data was given by 11% of participants.

Figure 4.14

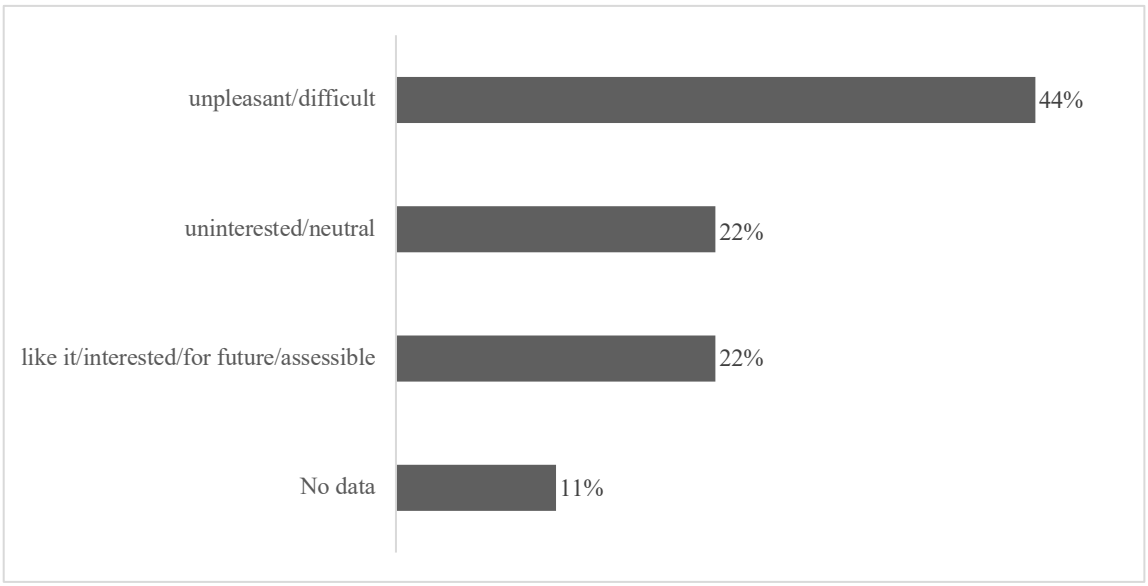
Barriers Participants Experience with Science.



Note. N=116

Figure 4.15

Barriers Blacks/African Americans Experience in Math Courses.

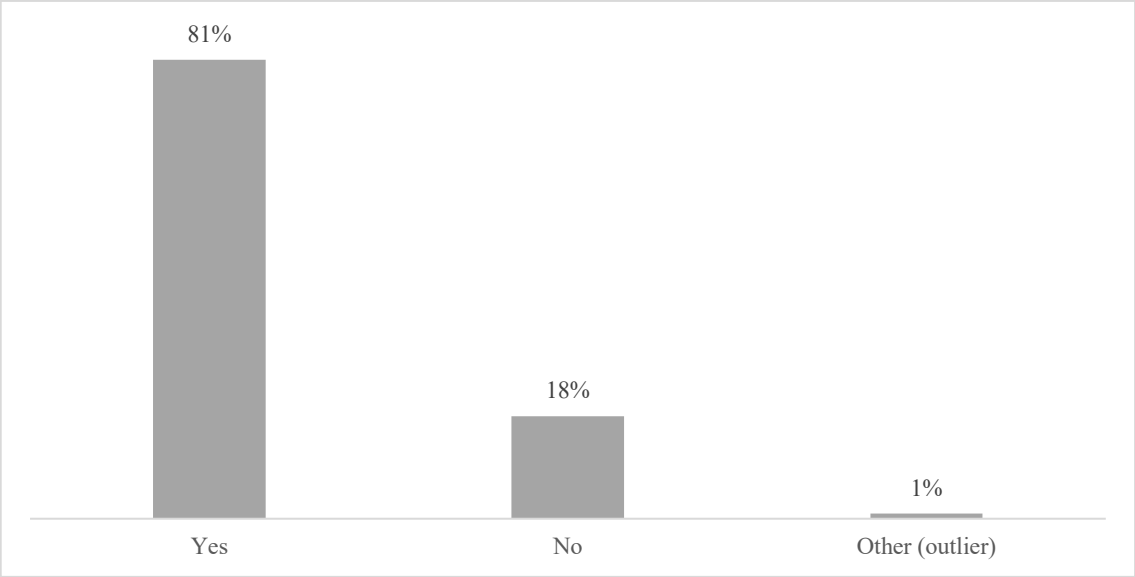


Note. n=9

According to Figure 4.16, 81% of the participants indicated that they were taking a math course. Eighteen percent revealed not in a math class. One percent gave an outlier response. One-third of the Black/African American participants were not taking a math course.

Figure 4.16

"I am Currently Taking a Math Class."

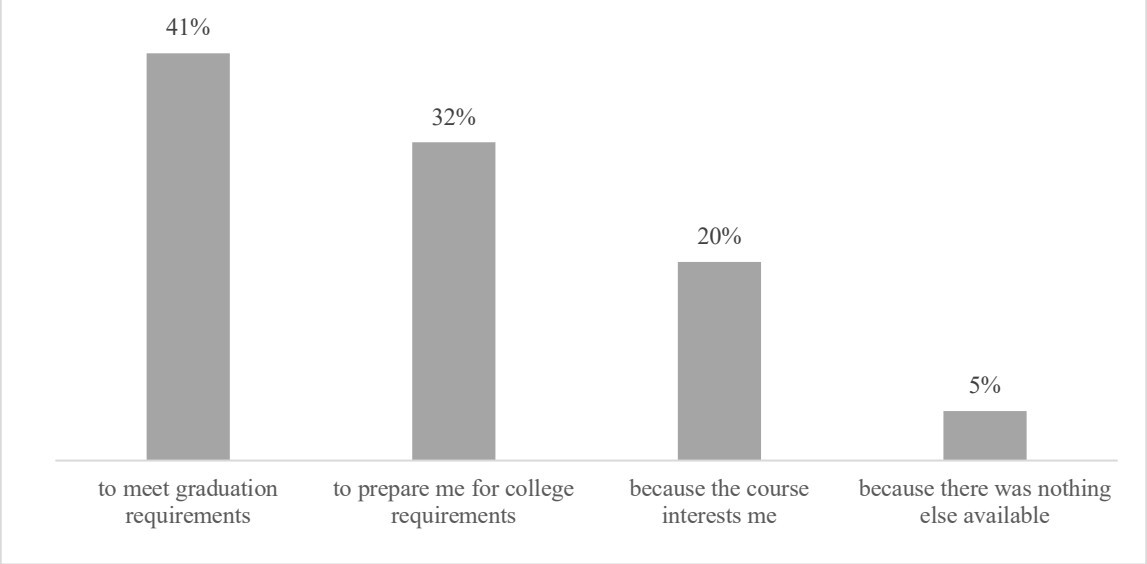


Note. *N*=116

Sixty-three percent of the respondents stated requirements as a motivation for their math class enrollment. At 40%, most of the participants indicated that their main reason was due to meeting graduation requirements. Followed by as preparation for college requirements at 32%. Twenty percent acknowledged interest in their math course. Lastly, 5% listed that there was nothing else available.

Figure 4.17

"Why Am I Taking This Math Course?"



Note. *N* = 116

In Table 4.9, the interviewing subgroup revealed that Black students stayed away from STEM courses because they do not want to be the only Black student. Having a few Black students in the class was also a negative. The fear of failure was mentioned another possible reason.

Table 4.9

Barriers Inhibiting Black Students from Enrolling in STEM Courses.

Interviewee Number	Response
#001	"they probably would get a sense of who I'm probably going to be the only one, the only black person. I noticed that because when I took chemistry, there was only three people in that class when I took it."
#002	"very few black kids in your class."
#003	"Your brain won't do it, because one, fear. You're scared you're going to fail, and then you're lazy to even put in the work to do it. So, I think that's why it's like laziness. I'm just thinking a lot of students. I can just name them from the top of my head that they could have did it, but they're lazy."
#004	"Maybe that, because the classes, I'm not going to say hard, but it requires a lot of your attention."
#005	"I think that we're underrepresented, I would say a lot of us... A lot of people, I know a lot of classes, when I asked another black person, "Why don't you join this AP with me?" "…I don't want to sit in there and have everybody look at me." That's what they say."
#006	"Yeah. I think one is the first question, that you don't see many of us there. I feel like even though you know you're supposed to go and do school for yourself; you also want to have a friend in the class, somebody that you can talk to and just help you get through that class when you're struggling and everything. Then also, I think that ... Yeah. I think it's just fair for the most part. They just want to pass and they don't want to push themselves or scared of what will happen. So yeah."
#007	"But again, I think it's just people playing it safe and not really exploring other careers and majors, whether it's biology or science-related or anything like that. And I just see a lot of people, African Americans, I see them doing human studies and communications and stuff like that. But I think there's just this stigma that there are a lot of African Americans in science, technology and that field."
#008	"I just feel like a lot of people stay away from it."

Note. N=8 Interview response by subsample

Research Question 3

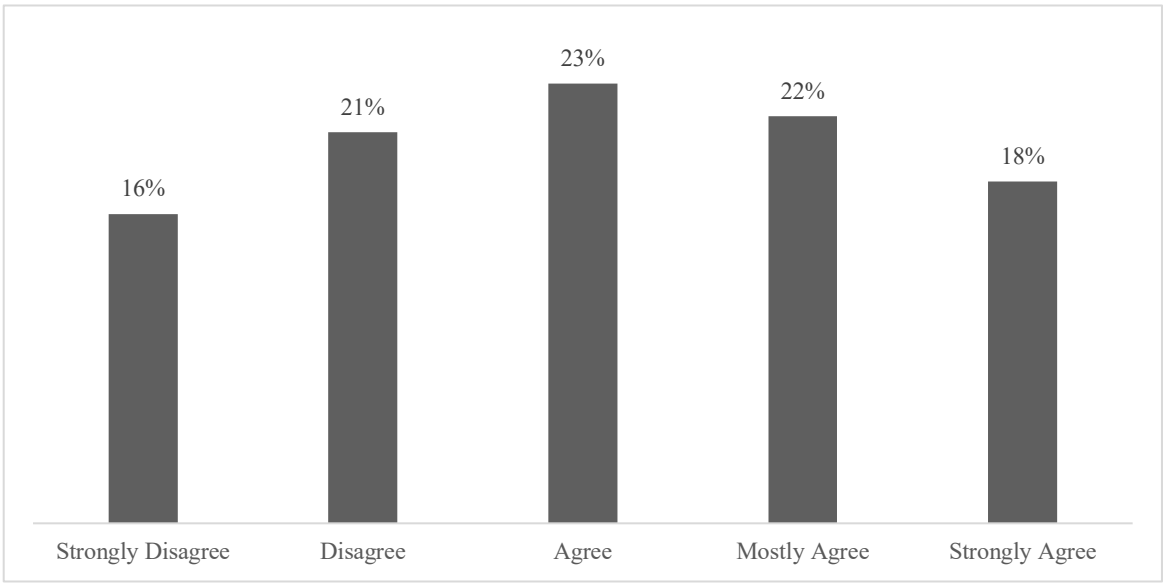
Why do Black students opt not to declare as a STEM major when applying to college?

The results of a Likert-type scale question, ranging from Strongly Disagree to Strongly Agree. More participants (63%) agreed with the statement of "there are classes in the STEM field that I am interested in that I have taken" than disagree (37%). The reporting from STEMconnector and My College Options, indicated that almost 60% of US students showed

interest in STEM before abandoning the interest by graduation (Munce & Fraser, 2012).

Figure 4.18

Interested in STEM class?

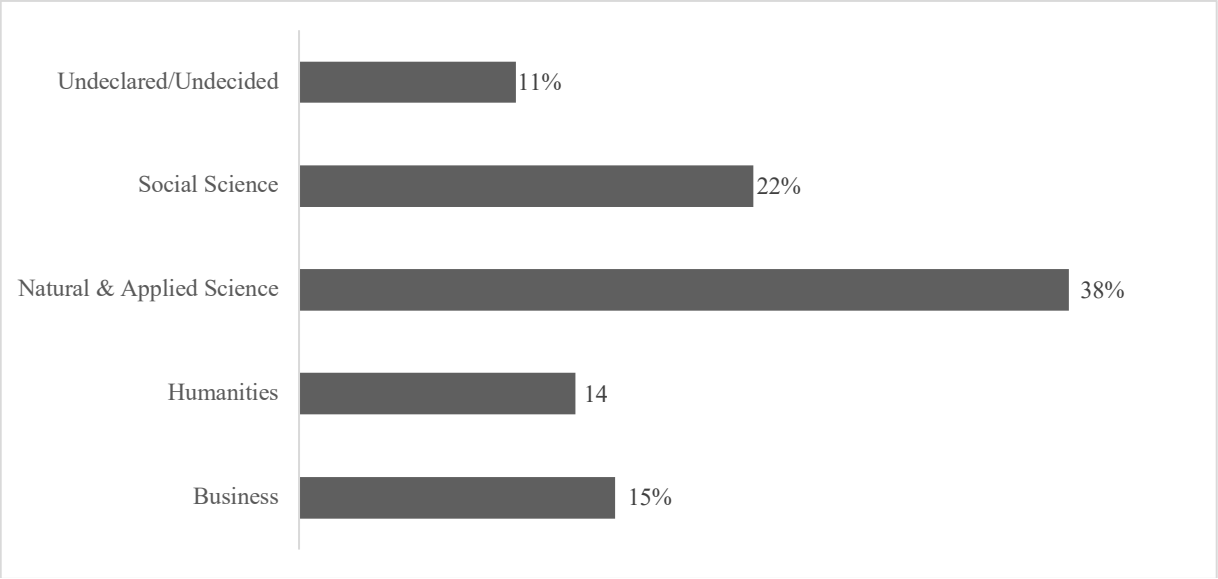


Note. N=116

According to the data, 38% of the respondents planned to declare as a STEM major. Fifty-one percent planned to take a different path, 22% in the social sciences, 14% in humanities, and 15% in business. The remaining 11% are undecided and undeclared (Figure 4.19). The Black subgroup mirrored the overall data breakdown. They did not have a student planning to declare as a STEM major.

Figure 4.19

Declaring Major



Note. *N* = 116

Interviewed respondents shared various thoughts for non-enrollment as STEM major when entering college. They included lack of representation, fear, and belief a STEM major was difficult to name a few (Table 4.10).

Table 4.10

"Why are they not choosing to major in STEM when enrolling in college?"

Interviewee Number	Response
#001	"Oh no, it's going to be a lot of work. It's something that I feel like African Americans, don't get a support system for, or get the courage from anybody telling them you should do this or you should try this. Or if I'm more so not trying, trying to motivate them into trying, see if you like it then okay, if we don't like it then, okay. We understand that. They weren't doing that."
#002	"They're not interested in that."
#003	"You can start, but if you know you're not going to have the money to continue this big STEM major, it's not going to work. I feel like they just give up."
#004	"Because they don't have the right information."
#005	"If you do look at a lot of STEM images, not a lot of black people. Or if you look at who is big in STEM, it's not... I don't think it's ever somebody and there isn't really a black person."
#006	"They feel like it's going to be harder when they hear that word and they see that word, so they're like, "I'll just go for business right now. I'll just major in business real quick and then I might switch over later on."
#007	"the groups that I see, they didn't really have African-Americans. It was mostly Asians into math and science. But no, I never saw any African Americans. So, I think if there was groups targeted towards African-Americans that are STEM-based, maybe they would be more into STEM majors."
#008	"Because they think math is hard. It sounds hard, saying that you like... STEM majors include stuff like being like engineers, into the medical field. Because no one's going to jump to that."

Note. $N=8$

Summary

The researcher reviewed data and discussed in detail the findings of the results. Key elements included aligning research questions with results and determined how qualitative and quantitative brought together the key finding that will be discussed in Chapter 5.

CHAPTER 5: DISCUSSION

This study examined Black student participation in STEM courses by surveying secondary school science students and interviewing Black students as a sample. The intention of this chapter seeks to expand understanding of the factors producing low enrollment for Black students in STEM courses and their reluctance to choose STEM disciplines as college majors to pursue. The study incorporated student perspectives along with recommended practices and further research to better enhance the Black student experience.

Underrepresentation in STEM

The first research question was Why are Black students underrepresented in high school STEM classes? Black students were represented in the required STEM courses and underrepresented in high school advanced STEM classes. According to Table 4.7, 66% of the Black students in the study indicated their math enrollments. The classes indicated are prerequisites math classes for graduation, and none enrolled in the math advance placement classes. Interviewees shared their experience of being disregarded, feeling out of place and observed this treatment as normal in comparison to other subgroups. They also shared that though it is unfair, it is their reality.

The sense of doubt served as another motivator not to participate in the STEM elective courses. The lack of encouragement from the adults on the school site or targeted recruitment played a factor in the underrepresentation of Black students in STEM elective classes. In the survey sample, Black students made up less than 15% of the enrollment in the technology courses, 0% in the Advance placement Computer Science courses, 55% were enrolled in a science class only, and 0% in any of the Advance placement science courses. The chemistry was the only science class chosen and the prerequisite for graduation. These results are connected to

the Equity Sensitivity theory because the respondents allude to the continuum of fairness. "I feel like a lot of the Black students, either they don't know, or they don't think they're good enough to take those classes. Because it sounds scary, right?" The respondent reflected on their statement with disbelief and sadness. The students felt an underlining sense of an opportunity missed. As stated in chapter 2, the disparities in large technology corporations show the bleak representation of Blacks. The data alone could not sustain consistent changes in the workplace, and it rolled back efforts making the shifts (Brown, 2020; Glaser, 2020).

Barriers to Enrolling in STEM

Research Question 2 asked, *What are the barriers inhibiting Blacks from enrolling in STEM courses?* The data from the survey presented feelings of unpleasantness, disinterest, and difficult experiences regarding math (66%). With regards to science, many of the students were unaware of why they were not in a science course, expressed indifference and satisfaction with meeting the minimum requirements needed in science for graduation (45%). During an interview, one echoed a repeated opinion, “I just feel like a lot of people stay away from it.” These attitudes indicated the apathy that was set in this sample subgroup regarding STEM disciplines. It also entrenched a mindset within the group that convinced others to believe it as well. This tacit agreement established an echo chamber and culture of exclusion. This stalled any positive shifts for recruitment in the STEM courses. Previously noted, students move to other fields due to lack of exposure and feeling unfit for the demanding coursework in an environment where severely outnumbered (Escobar, 2016).

Seventy-five percent of the interviewees expressed they experienced distress and pain while in school. The hardship varied from the deaths in the family, homelessness, consistent onslaught of disparaging comments, and custodial issues. Their trauma burgeoned continuously,

with many experiencing more than one traumatizing event or situation. As reported earlier, parental SES influenced a child's subsequent job fulfillment (Duncan & Magnuson, 2005).

Further worsening came from being at the mercy of the problem since they had no control and were minors. Balancing their studies and managing the upset in their lives proved almost impossible in the face of these situations, with 66 % of them sharing the impact on their grades and experiences in the STEM classes.

Despite the impact, 50% persevered and were able to turn around a class grade from failing to improving their grade. In addition, 75% of the interviewees were in a STEM class their senior year. Overcoming their adversities equipped them with life-tested tools needed in navigating future challenges. These examples connected to and supported grit and self-determination theories as mentioned earlier because they demonstrated perseverance over adversity and the willingness to incorporate life lessons into their identity discussed (Duckworth et al., 2007; Ryan & Deci, 2000).

Lack of representation appeared to be a common factor. One student shared when they asked a friend to join them in a STEM class; the response was, "I don't want to sit in there and have everybody look at me." This insight again mirrored what other students stated. This lack of visual representation led them to believe that it was inconceivable to be a part of these classes and be successful. The data uncovered the sense of exclusion of the Black/African Americans from the STEM classes and, therefore, the inability to see themselves as STEM scholars. This also corroborated theoretical framework, self-determination theory. It spoke to how Black students related to themselves, to the in-group of other Black students and how they related to other subgroups. They also seemed to be unaware of the benefits and opportunities students in these classes receive by enrollment. As shared earlier, not knowing the Black scientists and

inventors keep them thinking alone, feeling ostracized, unaccepted in the room (K. H. Collins, 2018; Waxman, 2020)

All the findings for this question corresponded to the winner-take-all model some schools fall into, building a stratification among students where learners who are not the top performers take fewer advanced mathematics and science courses compared to their counterparts in less respected schools (Attewall, 2001). The data collected reflected as the top performers surveyed made it into the impacted classes were informed regarding opportunities tied to the courses and proactive regarding fulfilling the requirements needed to be successful in a discipline (Table 4.9). The reasons stated for the barriers speak to the importance of networking and forging strong relationships among stakeholders, ensuring student success.

STEM Major is Not a Choice for Black Students

The sample population of Black students who took the survey indicated they would not pursue a STEM major due to fear of failure and the belief of not being good at the STEM disciplines. This began to answer the research question three, *Why do Black students opt not to declare as a STEM major when applying to college?* One interviewee added the Black students avoid majoring in STEM "because they think math is hard. It sounds hard, saying that you like STEM majors include stuff like being like engineers, getting into the medical field. Because no one's going to jump to that." It occurred that these professions lay beyond their reach, requiring large amounts of attention that could be put into other things (Table 4.10). Noted before, in the literature review, representation impacted expectation as African Americans were often portrayed in service working jobs. Therefore, students' expectations and subsequent actions replicated it.

The student perceptions discussed the impact of their observation by sharing that "the groups that I see, they didn't really have African-Americans. It was mostly Asians into math and science. But no, I never saw any African Americans. So, I think if there were groups targeted towards African Americans that are STEM-based, maybe they would be more into STEM majors." It appeared there is no active recruitment of Black students in STEM elective classes on the school site, as well as providing high achievement support. This corroborated Ladivar (2013) research on current STEM occupation breakdown with over 40% Asian and 17% Black representation.

Furthermore, the student engagement after they either fail or start to fail does not endear confidence. A student noted their impression for possible pursuits, "Oh no, it's going to be a lot of work. It's something that I feel like African Americans don't get a support system for or get the courage from anybody telling them you should do this, or you should try this. Or if I'm more so not trying, trying to motivate them into trying. See if you like it, then okay, if we don't like it then, okay. We understand that. They weren't doing that" (Table 4.10). The interviewee was suggesting that in addition to the nonexistence of support services needed, encouragement proved essential to having them explore what is possible—not struggling kept the Black student inexperienced and unaware of their capacities.

Implications for Practice

There were six key findings in creating support for the Black students around STEM and STEM pursuits. The first finding addressed how Black students in this study experienced a series of hardships with little or no support. While the student-athletes received support from their teammates, 40% did not. Though the school instituted some support services like grief counseling and art therapy groups, there was a need to reach out to peers for healthy and positive

support. Therefore, cultural clubs like Young Black Scholars (YBS), Black Student Union (BSU), and STEM clubs targeting Blacks students like Mathematics Engineering Science Achievement (MESA), National Society for Black Engineering Jr (NSBE Jr.), and Math League all need to be used effectively to create a deep and wide net for students to use when they experience trauma and hardship. These programs were already potential places where Blacks students congregated, networked, and motivated each other as they led in creating safe spaces outside the classroom, started opportunities for STEM support both in remediation and advancement where peer tutoring and peer conversations were possible. The problem came from the student's lack of knowledge of these programs, and so there needed to be explicit and direct counseling and recruitment of Black students into these programs. It should not be just one teacher adviser, but a whole school initiative for every Black student to know these organizations exist. This validates Davis (2018) by using these programs, research the school as a community will be building a mindset that is central to caring for the Black community.

The second finding highlighted how outside influencers, negative media messaging, and doubters and their pervasive mindset of black mediocrity actively discourage Black youth from attempting to take STEM elective courses. Due to the isolating results of the global pandemic, 50% of the interviewees chose to pursue STEM. When asked why they cited that they were away from those that either did not believe in them, those who state the amount of work as cause to pursuit STEM and plainly found out the economic benefits. Steps to tackle this issue include reinforced school messaging Black figures in STEM both visually and weaved into curricula. Creating motivation campaigned need to remind students of their capabilities, that failure was a part of the learning process, and their need to recognize and counter the destructive and micro-aggressive comments they will encounter in their education. The purpose of the campaign should

be to start the healing process and allowed Black students to choose STEM as a possibility out of curiosity and vigor rather than fear and misgivings. This substantiated Sondern (2019) that Black role modeling beyond Martin Luther King Jr needs displaying and discussing. Black role models may not have had modeling that mirrored them however they persevered.

Following this, the third finding illuminated how remediation had taken over the time outside of regular school hours. The credit recovery classes became a safety net and, for many, the main source and opportunity to pass classes. Gone were the opportunities to move ahead during summer school. The lack of push for excellence created a culture of mediocrity. To combat this, tiered support where students were enrolled in a learning lab in tandem with the STEM course will lessen the need for extra classes in the back end. Running parallel to this academic support, a focus on how to navigate the education system must happen not only with the students but also with their families. This service reduced the number of fails. Black students no longer needed to worry about failure because they know there was a service to assist in accessing the material.

The next finding spoke to the insecurities of Black students where they do not feel safe. As explicit recruiting occurred for Advance Placement and STEM elective courses, there needed to be at least five or more Black students in the class to foster inclusion, camaraderie, and motivation while preventing the sense of isolation, ostracization, and fear. Recruiting from the culture clubs like BSU created another access point to build capacity in these classes. It led to the rebirth of Black literacy societies (Muhammad, 2020).

The finding five demonstrated counselors need bias training and consistent check-in to reinforce the material. This training and yearly follow-up with self-evaluation could be akin to the child abuse, blood-borne pathogens, and sexual harassment in the workplace programs that

were done by all school employees as part of their professional development and professional expectations. It upheld what multiple researchers suggested regarding the lack of sensitivity exhibited by academic counselors in PWI (Runyowa, 2015; Wallace & Bell, 1999; Weingarten, 2017).

Finally, and probably most critical, looked forward and towards the future, Black students need to be surgical when choosing a STEM pursuit because not all STEM fields were created equal. The diverse nature of the STEM labor market included both scarcity and overabundance of positions and prospective employees. For example, the US government job and governmental-related jobs need specific job posts filled with persons possessing Ph.D.'s specifically in material science engineering and nuclear engineering. Qualified professionals were in short supply in areas of cybersecurity, systems engineering, and intelligence, keeping a US citizenship which had excluded many foreign nationals (Xue & Larson, 2015). However, according to Xue and Larson (2015), the academic sectors absorbed the oversupply of Ph.D.'s in biomedical and physical sciences as an example. Therefore, open permanent positions were challenged to obtain. The projected numbers released in 2020 could impact Black STEM high students and highlight the need for STEM jobs filled. Aligning their interests or being open to exploring these sectors were possible avenues to support Black communities and increase family wealth. Figure 5.1 showed the job numbers for 2019 and indicated a projected 8% increase in 2029. Though pay difference between the STEM and Non-STEM jobs was vast, meaning the necessity of an advanced degree. The impact in creating multiple paths or opportunities for the next generations within the communities encourages a more significant return. Continuing with the example of Material Science as a possible career, the class of 2021 would be poised to have the advanced degree needed to meet the demand of private and public sectors seek.

Table 5.1

Employment in STEM Occupations, 2019 and Projected 2029

Occupation category	Employment		Change, 2019-29		Median annual
	2019	2029	Number	Percent	Wage, 2019
Total, all occupations	162,795.6	168,834.7	6,039.2	3.7	$39,810
STEM occupations	9,955.1	10,752.9	797.8	8.0	$86,980
Non-STEM occupations	152,840.5	158,081.9	5,241.4	3.4	$38,160

Note. Numbers in thousands (U. S. Bureau of Labor Statistics, 2020)

Transforming School Culture

By engaging stakeholders with the Black learner's best interest place in the forefront, all parties discovered that they were integral members of one team that will advance the success of the student.

The Impact of the High School Educator

The notion of fairness played a significant role in how Black students engaged with school officials. The need for fairness was the result of the current system at play. This system appeared to provide resources for all and contends accessibility for all. However, the Black student experience differed significantly from other subgroups (DeSilver, 2019; Hanover Research, 2017). Whereas there were doors of opportunity for most students, Black students must content with squeezing through a half-closed window. There was a time where Black students were taught to be twice as good to get half as much. This mindset lived, but the proportion had decreased yet still slanted against Blacks. The concept of gradualism was at play where eventually reaching equality (Saylo et al., 2011). But how long and how many generations will be lost before it to be fair for all? The equity sensitivity theory spoke to the imbalance perceived by the marginalized. The subtle actions implicitly created a hostile learning

environment for Blacks. The message was “there is no room or seat for you” produced demotivation and low work output.

As educators, acknowledge there was a problem and engage in understanding the nature of it. There were responsible for correcting that unfairness and take on remediating it within their sphere of influence (the classroom). One way to broaden the scope of the coursework were to have Black students see themselves as part of the material. Including identity as a means to interact with the material, created inclusivity of subgroups (Howard & Reynolds, 2008). This confirmed Muhammad (2020), the educator must choose to take this responsibility to figure out how to weave Culturally Responsive Pedagogy in their discipline. This action started to dismantle the Eurocentric worldview of education in the United States. Educators had the opportunity to encourage students to participate deeply in their learning (Flanagan, 2019).

As guides, educators picked up information that was valuable for students and families. There was so much to navigate that students count on their teachers to share pertinent information that adds to student success. Black families were especially vulnerable because they did not engage with the school community in great numbers.

Thirty-seven percent of the students in the study subsample shared that they did not know certain information that would impact the course selection until the junior and senior years. Outreach attempts were necessary for shepherding both Black families and their children regarding the resources that will inevitably shift the trajectory of the family-like preparing for the Black College Expo. A prepared student had their transcripts and letter of recommendation ready in multiple folders. Students dressed for success in interview-ready attire. The average Black family or students may not be aware it was going on, or they attended and may missed the opportunity on the spot enrollment. Black families needed to know these fine points and

overlooked them because college culture is ubiquitous at the school site but may not be at home.

Another issue an educator could advocate for was increasing the faculty makeup to match the student population. This initiative would help guide Black students along, increase role models on campus as they see that they have a place in the education landscape. Non-Black colleagues benefitted because they interact with these subgroups in a professional and perhaps personal manner. This interaction allowed for and enabled the development of empathy for their Black students. It also substantiated Muhammad (2020) regarding Black teacher representation and the call for it over decades.

Self-advocacy was an important skill to impart to students as it provides confidence to ask when help is needed and deals with the hostile environments they frequent. Black students need to share that their needs are essential, and they should not allow others to ignore or take advantage of them. As they take this action, they were highlighting the inequities established by the system that necessitates advocacy. To advocate, there must be parallel cultivation of self-efficacy. As stated in chapter two, the current system relied on systemic racism. The experience of doubt the students from the subsample shared points to the shortage of self-efficacy missing within the subgroup (Table 4.8).

Lastly, educators must take regular bias instruction and showed reliable check-ins to emphasize the material. This instruction consisted of sequential exercises allowing for self-evaluation. The program series could be analogous to the child abuse, bloodborne pathogens, and sexual harassment in the workplace training that all school employees expected to complete as part of their professional development and professional expectations.

Personnel to Support and Guide

The research clearly determined the power of relationships. The high school counselor, the teachers and the parents all have a part in planting the idea, supporting ways for the student met and got connected to STEM professions.

The Power of the High School Counselor

The high school counselor was tasked with an enormous responsibility, namely, to help families navigate the complexities of the college-preparation process. Often times the high school counselor was also the first person a parent calls when there were questions or issues arose. Their relationship started at the student's 9th-grade year, where they began to create their graduation plan. It then continued to the 10th grade where the student explored their curiosities or encouraged to use available tools to assist finding out their interests. The relationship between the academic counselor and the pupil was more than picking the class for the year to meet the graduation requirements for their district and possible post-secondary institutions.

Families relied on the counselor to present, remind, empower, support, and service (PRESS) their students on the intricacies of college-going or post-secondary options. Presented to the students and families their options and tied their interests to what is available was essential because many students may not know how to think in the future tense—reminding students of their goals, dreams, and the purpose of secondary school when it gets overwhelming or confronting—empowering students to take steps forward to explore what is possible to expand their growth. Supported their development through encouragement and to take on new challenges like taking advanced coursework and listen. Listening to their student/family concerns and listen for their student's greatness as they provided the services families and students needed. This relationship was integral because when opportunities surfaced, the academic

counselor provided the connection. Though each student's needs may differ, and the caseload of students may be daunted, the PRESS approach created accountability that left the student prepared for what is next. It called for a plan that once the student reached the 11th grade, and their attention (family, student & counselor) moved towards completion. The plan became clearer, and all stakeholders are ready. Even if the student was unsure, they counted on a plan was in action to support their journey.

Depending on the size of the school or district, an additional counselor dedicated to post-secondary options may assist. The responsibility of guiding students to the next stage of preparation was up to the college counselors. They provided additional support and focused on what is expected from outside the confines of the secondary school. As the academic counselor supported the student and impressed the student on the benefits of a strong transcript and extra-curricular resume, the college counselor took that plan and showed the student how far it could take them. Once again, the college counselor applied the PRESS approach to ensure students meet the deadlines and criteria established by the outside entities.

It cannot be stressed that this method is moot if the following are unavailable to the counselor:

1. Culturally Responsive Counseling- Training and reinforcing of Culturally Responsive Counseling where they were not only listening to the concerns but what is not said. They were reflecting on their own biases, micro-aggressive tendencies, and insecurities then checking them for the sake of student success.
2. Culturally Reflective site -The school site had a school culture fostering social justice, equity, and Culturally Responsive Pedagogy as foundational or as pillars—a site where all students' cultural backgrounds and ethnicities are seen as assets. Difficult

conversations had in service of fulfilling the mission and vision statement put forth by the school itself.

3. Stakeholder partnership-All stakeholders were consistent trained in listening, advocating, and supporting each other. Parents especially were not privy to the latest supports available that will enhance their families' experience as the interface with the school. Schools know the past relationship Black families have had with public institutions and engaged with them from a place of empowerment.
4. Counselors and educators needed bias training and consistent check-in to reinforce the material. This training and yearly follow-up with self-evaluation could be akin to the child abuse, blood borne pathogens, and sexual harassment in the workplace programs that are done by all school employees as part of their professional development and professional expectations.

The Support of the High School Black Parent

We were told in many instances that relationship matters. A healthy school relationship depends on communication, mutual respect, and support for one another. Communication involved clearly and consistently shared with Black parents the classroom intentions and commitments. These commitments entailed how they can support their child and ways the teacher and parent maintain dialogue. The teacher began to see the Black parent as a partner and can call upon them for collaboration.

Depending on the parent's culture and past experiences, educators were seen in various ways. The continuum of the sage, the combatant, and the non-confrontational archetypes did not give the freedom needed to interact with the parents in a healthy manner. The concept of mutual respect entailed that both parties have equitable insight. Degrees and certifications were put to

the side to encourage meaningful discussions about the student.

Support for one another means that Black parents were welcomed and saw their role as an integral part of the educational process. The Black parents possessed a social network that has the capacity to support the classroom. They brought resources that will augment the student's experience because their culture was seen and valued. The support of the Black parent ensured the student understands there was a united team dedicated to their academic and social-emotional success.

The support of high school Black parents was available when proactively reaching out to them includes sharing "glows" as well as "grows" for their student. This suggestion supported early in the semester based on varied assessments and check-in approaches with students. The intention was to foster and modeled healthy school relationships for the social, emotional well-being of the pupil.

As Black parents engaged with the school site, they had an opportunity to meet other parents and formed parent interconnected social networks. "In many ways, when educators know that you are informed, they make sure that they do right by your children. So that would be my number one issue, get involved, and make sure they (school personnel) know who you are" (Howard & Reynolds, 2008). They could support the campus clubs and share network practices that have to help them. These actions brought about parent mentorships. Black parents also gained knowledge on how the school functions first-hand. Schools needed to find out the best ways to communicate with them and was opened to multiple communication forms. The relationship started before school begins. Black parents needed to learn about their child's options like enrolled in advance placement classes, dual enrollment in community college courses, and little-known summer programs. These tips assisted in navigating the system with

fidelity. Therefore, forged a healthy relationship with parents allowed consistent meetings with academic counselors regarding the student education graduation plan. Difficult conversations regarding course work and course selection were possible because centering the Black student's success is paramount. It upheld Chuah (2010) drawing from Asian parents created network to amplify their reach and understanding resulting in benefits for their children. It also ensured proper alignment is maintained.

One student shared with the researcher that they were unaware of their school pathway until a teacher requested the class found out. They were in the 11th-grade and met with their counselor multiple times and not mentioned. They wondered what missed opportunity resulted in not knowing. The Black parent cannot wait for an invitation because the child needed the parent advocacy. Otherwise, the Black student continued not to access the resources owed to them as a school community member.

Recommendations for Further Research

It was recommended that more data regarding STEM participation be collected over multiple secondary schools and compared to this study. The role of STEM teachers was vital to the participation of Black students in these courses. It was recommended future studies ask STEM teachers what they do to support Black students and/or provide strategies and investigate if the strategies are implemented.

It was appropriate for future research to ask, what were educators' current perceptions regarding marginalized subgroups like Black students in terms of STEM course enrollment and post-secondary STEM pursuits? Will the insights express what is missing in stakeholder relationships? Could it reinforce and contradict what the students and specifically Black students shared? Is there a commonality between their peers and with students? As an important and

underutilized stakeholder, Black parents engaged in more productive ways. Finally, it was recommended that future studies involved Black parents and their role transformed Black students' underachievement in middle and high school. There was much work yet to be accomplished.

Current events of the last couple of months necessitated a new educational policy. Such policy called for exposing Black students to STEM or STEAM curricula as early as Transitional Kindergarten (TK). Early and consistent exposure throughout TK-12 demystified the concepts and disciplines of STEM. As it encouraged more participation and informed their parents of the possible avenues, their children may pursue. The policy created opportunities for students, teachers, and other staff members to learn more about Blacks and African Americans' contributions to STEM history.

Therefore, Culturally Responsive teaching made it possible to engage students on what and how they could learn. It created multiple avenues for students to access the STEM/STEAM curriculum. As it drove the importance of teaching with an asset-based approach, it broadened the view of STEM contributors' past, present, and future. Moreover, all TK-12 teachers needed to be well versed in Culturally responsive pedagogy as foundational and school counselors trained in Culturally responsive counseling as they fulfilled this educational policy.

Summary

This chapter consisted of interpreting the findings, the implication for practice, ways to transform school culture, and recommendations for further research. The study impacted the researcher. As a school leader, the researcher had an opportunity to encourage colleagues to expand and introduce literature that fosters meaningful conversations around rigor, relevance, and relationships. It also influenced her interactions with students and parents. The study

informed the department's professional development. Its trajectory led educators to reflect on their craft and expand on how they deliver the curriculum. Members of the department showed signs of investment through participation and in building innovative curricula were inclusive and productive. Educators crafted opportunities for their growth and development and expanded on how students can utilize the skills learned in class to examine their surroundings.

This study also created opportunities to engage other cadres within the school site. New and uncomfortable conversations-initiated self-reflection among the staff led to additional data collection from students and presentations to campus stakeholders.

Conclusions

The participants shared their struggles and hardships, they demonstrated their resiliency. They did so by overcoming the barriers, negative messaging, and life setbacks to push forward. It became apparent the stakeholders (school, parents, and students) had a say on how the school progresses and treat each other. This study highlighted disparities that exist in STEM elective courses regarding Black students.

The study contributed to the body of work regarding STEM access to Black students and began to discuss the reluctance to pursue STEM fields. The research questions were linked and lead into another. Therefore, investigating whether there was a lack of representation that led to student insights regarding the STEM disciplines. This recognition allowed for the acknowledgment of the lack of representation within STEM elective courses.

The study uncovered that discouraging thoughts and words, no explicit targeted Black recruitment, and lack of support system depresses Black students from electing to pursue STEM fields as a possibility. Researchers referred to academic momentum as the speed it takes for a student to complete a STEM degree based on the course load taken in the first semester of

college (Attewell et al., 2012). Thus, taking a break or having a low credit load lessened the probability of degree completion. Not having the academic thrust or the intentional building of scholarly drove at the secondary school level puts Black students at a disadvantage regarding STEM pursuits. Many of the students recognized the absence of such push into STEM impacted their academic momentum before applying to college and often caused them to try another field as a safer option.

Updating traditional STEM classes like math to demonstrate relevancy needed to be at the forefront. Until the learners saw the connection between STEM-disciplines' theory and its application to their life, the results will be more of the same. Little progress made or seen. STEM teachers and professors continued to see their students struggle more than necessary to balance equations or solve quadratic equations that most likely underutilized. The purpose of having buy-in from the student may change the path and their experience of STEM. Therefore, there must be a collective effort to make connections.

Providing and supporting courses that served a utility for the real world versus theory was not only practical, and it had students acquire more skills to care for themselves. There is plenty of room to have the class be challenging and applicable as it reduced the indifference exhibited by the Black students. STEM curiosity presented and needed to be fostered by schools.

REFERENCES

AAC&U News. (2017, June/July). *Facts & figures – Higher education and the American dream | Association of American Colleges & Universities*. Association of American Colleges & Universities. https://www.aacu.org/aacu-news/newsletter/2017/june/facts-figures

AAPCHO. (2009). *Pipeline programs to improve racial and ethnic diversity in the health professions* (p. 110). UC San Francisco. https://www.aapcho.org/wp/wp-content/uploads/2012/11/PipelineToImproveDiversityInHealthProfessions.pdf

AchieveMinneapolis. (2016, April 21). *EDtalks: Dr. Keith Stanley Brooks "Critical race theory—Fact vs. feeling."* YouTube. https://www.youtube.com/watch?v=3yizS9DMENE

Adams, A. (2019, January 14). *To each their own: Power to the parents!* New York School Talk. http://newyorkschooltalk.org/2019/01/to-each-their-own-power-to-the-parents/

Adams, S. (2015, April 15). *The college degrees and skills employers most want in 2015*. Forbes. https://www.forbes.com/sites/susanadams/2015/04/15/the-college-degrees-and-skills-employers-most-want-in-2015/

Agarwal, P. (2018, August 26). *Here is why organisations need to be conscious of unconscious bias*. Forbes. https://www.forbes.com

Agrawal, R. K., Stevenson, M. L., & Gloster, C. (2016, June 26-29). *Understanding the reasons for low representation of ethnic minority students in STEM field* [Paper presentation, ID# 14419]. 2016 ASEE Annual Conference & Exposition. New Orleans, LA. https://doi.org/10.18260/p.27105

Aguilar, E. (2011). Coaching teachers: what you need to know. *Education Week*. http://www.edweek.org/tm/articles/2011/02/15/tln_coaching.html

Ainsworth-Darnell, J. W., & Downey, D. B. (1998). Assessing the oppositional culture explanation for racial/ethnic differences in school performance. *American Sociological Review*, *63*(4), 536–553. https://doi.org/10.2307/2657266

Alonso, F. J. (2019). *Bridging the opportunity gap: Motivational factors for underrepresented minorities in STEM careers* [Doctoral dissertation]. Concordia University Irvine, Irvine, CA. ProQuest Dissertations Publishing. https://www.proquest.com/dissertations-theses/bridging-opportunity-gap-motivational-factors/docview/2349665397/se-2?accountid=201395

Alvarado, S., & Muniz, P. (2018). Racial and ethnic heterogeneity in the effect of MESA on AP STEM coursework and college STEM major aspirations. *Research in Higher Education*, *59,* 933-957. https://doi.org/10.1007/s11162-018-9493-3

American Association for the Advancement of Science (2001). *In pursuit of a diverse science, technology, engineering and mathematics workforce: Recommended research priorities to enhance participation by underrepresented minorities* [Report]. https://pathwaystoscience.org/pdf/AAAS_In_Pursuit_Of_A_Diverse_STEM_Workforce.pdf

American Psychological Association, Presidential Task Force on Educational Disparities (2012). *Ethnic and racial disparities in education: Psychology's contributions to understanding and reducing disparities* [Report] (p. 121). American Psychological Association. http://www.apa.org/ed/resources/racial-disparities.aspx

Anderson, G. (2019, September 24). *Minority and first-generation SAT scores fall behind* [Education]. INSIDE HIGHER ED. https://www.insidehighered.com/admissions/article/2019/09/24/minority-and-first-

generation-sat-scores-fall-behind#.YRQpFUthycc.link

Anderson, K., & Francisco, A. (2019, March 6). *The research behind the TED Talk: Angela Duckworth on Grit* [Blog]. Digital Promise. https://digitalpromise.org/2019/03/06/research-behind-ted-talk-angela-duckworth-grit/

Anderson, M. D. (2015, December 7). *Why are so many preschoolers getting suspended?* The Atlantic. https://www.theatlantic.com

Anderson, M. D. (2017, April 25). *How does race affect a student's math education?* [Education]. The Atlantic. https://www.theatlantic.com/education/archive/2017/04/racist-math-education/524199/

Anderson, S. E. (1990). Worldmath curriculum: Fighting eurocentrism in mathematics. *The Journal of Negro Education*, *59*(3), 348–359. https://doi.org/10.2307/2295569

Andrews and US v. Monroe City School Board—Second Amended Consent Decree, No. 65-11297 (Civil Action July 12, 2017). https://www.justice.gov/crt/case-document/andrews-and-us-vs-monroe-city-school-board-second-amended-consent-decree

API. (2019, September 18). Holding power accountable: The press and the public. *American Press Institute*. https://www.americanpressinstitute.org/publications/reports/survey-research/holding-power-accountable-the-press-and-the-public/

Archer, L., Dewitt, J., & Osborne, J. (2015). Is science for us? Black students' and parents' views of science and science careers. *Science Education*, *99*(2), 199–237. https://doi.org/10.1002/sce.21146

Aronson, B., & Laughter, J. (2016). *The theory and practice of culturally relevant education: A synthesis of research across content areas*. *86*(1), 163–206. https://doi.org/10.3102/0034654315582066

ASCD. (2020). *School culture and climate*. ASCD Learn. Teach. Lead. https://www1.ascd.org/research-a-topic/school-culture-and-climate-resources.aspx

Attewell, P., Heil, S., & Reisel, L. (2012). What is academic momentum? And does it matter? *Educational Evaluation and Policy Analysis*, *34*(1), 27–44. https://doi.org/10.3102/0162373711421958

Badger, E., Miller, C. C., Pearce, A., & Quealy, K. (2018, March 19). *Extensive data shows punishing reach of racism for black boys*. The New York Times. https://www.nytimes.com/interactive/2018/03/19/upshot/race-class-White-and-black-men.html

Bailey, R. K., Mokonogho, J., & Kumar, A. (2019). Racial and ethnic differences in depression: Current perspectives. *Neuropsychiatric Disease and Treatment*, *15*, 603–609. https://doi.org/10.2147/NDT.S128584

Barge, J., & Loges, W. (2003). Parent, student, and teacher perceptions of parental involvement. *Journal of Applied Communication Research*, *31*(2), 140–163. https://doi.org/10.1080/0090988032000064597

Barrett, N., McEachin, A., Mills, J. N., & Valant, J. (2018). *Disparities in student discipline by race and family income* [Report]. Education Research Alliance. https://educationresearchalliancenola.org/

Barta, P., Chen, T.-P., Jou, D., McEnaney, C., & Fuller, A. (2020, June 28). How international students are changing U.S. Colleges. *WSJ*. http://graphics.wsj.com/international-students

Bartolome, L. I. (2004). Critical pedagogy and teacher education: Radicalizing prospective teachers. *Teacher Education Quarterly*, *31*(1), 97–122.

Bauer-Wolf, J. (2019, February 26). *Latinx, Black college students leave STEM majors more*

than White students [Equity]. INSIDE HIGHER ED. https://www.insidehighered.com/news/2019/02/26/latinx-black-college-students-leave-stem-majors-more-White-students

Berwick, C. (2019, March 12). Keeping girls in STEM: 3 Barriers, 3 Solutions. *Edutopia*. https://www.edutopia.org/article/keeping-girls-stem-3-barriers-3-solutions

Bigelow, M. M. (1970). Public opinion and the passage of the Mississippi Black Codes. *Negro History Bulletin*, *33*(1), 11–16. https://www.jstor.org/stable/24766779.

Boffone, T. (2020, March 10). *An unconventional approach to culturally responsive pedagogy* . Edutopia. https://www.edutopia.org/article/unconventional-approach-culturally-responsive-pedagogy

Boikeo-Weyrach, A. (2017, March 21). *Asian American students push to reveal what the "model minority" myth hides*. The World. https://www.pri.org/stories/2017-03-21/asian-american-students-push-reveal-what-model-minority-myth-hides

Boschma, J., & Brownstein, R. (2016, February 29). *Students of color are much more likely to attend schools where most of their peers are poor*. The Atlantic. https://www.theatlantic.com/education/archive/2016/02/concentration-poverty-american-schools/471414/

Boudreau, E. (2019, December 3). *Tracking achievement and inequality in U.S. Schools.* |Harvard Graduate School of Education. *Harvard Graduate School of Education*. https://www.gse.harvard.edu/news/uk/19/12/tracking-achievement-and-inequality-us-schools

Bowman, B., Comer, J. P., & Johns, D. J. (2018). Addressing the African American achievement gap: Three leading educators issue a call to action. *Young Children*, *73*(2).

https://www.naeyc.org/resources/pubs/yc/may2018/achievement-gap

Brancaccio, D., & Nguyen, J. (2018, February 5). *Where millennials stand on immigration*. Marketplace. https://www.marketplace.org/2018/02/05/where-millennials-stand-immigration/

Brittain, J., & Kozlak, C. (2007). Racial disparities in educational opportunities in the United States. *Seattle Journal for Social Justice*, *6*(2), 58. https://digitalcommons.law.seattleu.edu/sjsj/vol6/iss2/3

Brown, A. (2020, December 22). *Google Recruiter: Fired after pushing for more Black HBCU Engineers*. The Moguldom Nation. https://moguldom.com

Brown, B. A. (2005). "It isn't no slang that can be said about this stuff" Language identity, and appropriating science discourse. *Journal of Research in Science Teaching*, *43*(1), 96–126. https://doi.org/10.1002/tea.20096

Brown, C. S. (2015). *The Educational, Psychological, and Social Impact of Discrimination on the Immigrant Child* [Report]. Migration Policy Institute. Washington, D. C. https://www.migrationpolicy.org

Bryant, R. T.-A.-F. (2015, October). *College preparation for African American students: Gaps in the high school educational experience* [Paper presentation]. 3rd Annual International Colloquium on Black Males in Education, Morehouse College, Atlanta, GA. Center for Law and Social Policy (CLASP), pp. 1–17. https://eric.ed.gov/?id=ED561728

Burgess, D. J., Joseph, A., van Ryn, M., & Carnes, M. (2012). Does stereotype threat affect women in academic medicine? *Academic Medicine*, *87*(4), 506–512. https://doi.org/10.1097/ACM.0b013e318248f718

Burnette II, D. (2019, November 13). *Everybody supports "equity", but how do they define it?*

Education Week. https://www.edweek.org

Burt, B. A., Knight, A., & Robeson, J. (2017). Racializing experiences of foreign-born and ethnically diverse black male engineering graduate students: Implications for student affairs practice, policy, and research. *Journal of International Students*, *7*(4), 925–943. https://doi.org/10.32674/jis.v7i4.182

Bybee, B., McCrae, B., & Laurie, R. (2009). PISA 2006: An assessment of scientific literacy. *Journal of Research in Science Teaching*, *46*(8), 865–883. http://dx.doi.org/10.1002/tea.20333

Byrd, W. C., & Lopez, W. D. (2020, July 20). *College students will bring racial economic disparities of the pandemic back to campus. Are universities ready*? The Washington Post. https://www.washingtonpost.com/

California Department of Education. (2019, September). *CALPADS UPC Source File (K–12)—Student & school data files*. California Department of Education. https://www.cde.ca.gov/ds/sd/sd/filescupc.asp

Camara, W. (2013, Winter). Defining and measuring college and career readiness: A validation framework. *Educational Measurement: Issues and Practice*, 32(4)*,*16–27. https://doi.org/10.1111/emip.12016

Cambridge Dictionary (2016). *Brain drain definition*. https://dictionary.cambridge.org/us/dictionary/english/brain-drain

Campbell, S. D., Carter-Sowell, A. R., & Battle, J. S. (2019). Campus climate comparisons in academic pursuits: How race still matters for African American college students. *Group Processes & Intergroup Relations*, *22*(3), 390–402. https://doi.org/10.1177/1368430218823065

Career Academy Network. (2012, November 2). *The value of a STEM education [Infographic]*. Edutopia. https://www.edutopia.org/stw-college-career-stem-infographic

Carnevale, A. P., Cheah, B., & Hanson, A. R. (2015, July 7). The economic value of college majors. *CEW Georgetown*. https://cew.georgetown.edu/cew-reports/valueofcollegemajors/

Carpi, A., Ronan, D. M., Falconer, H. M., & Lents, N. H. (2017). Cultivating minority scientists: Undergraduate research increases self-efficacy and career ambitions for underrepresented students in STEM. *Journal of Research in Science Teaching*, *54*(2), 169–194. https://doi.org/10.1002/tea.21341

Carter, C. L. (Producer) (2019). Microassaults, microinsults, and microinvalidations. Video excerpts from Y. S. Niemann (Producer), *Microagressions in the Classroom*. University of North Texas. https://www.pbslearningmedia.org/resource/cb19-ss-types.microaggressions/microassult-microinsults-and-microinvalidation/

Casad, B. J., & Bryant, W. J. (2016). Addressing stereotype threat is critical to diversity and inclusion in organizational psychology. *Frontiers in Psychology*, *7*. https://doi.org/10.3389/fpsyg.2016.00008

Casey, M. (2019, March 6). *Journalists can't hold government officials accountable as news deserts rise.* Chicago Sun-Times. https://chicago.suntimes.com/2019/3/6/18414499/journalists-can-t-hold-government-officials-accountable-as-news-deserts-rise

Chan, M. (2013, April 2). *STEM: Good jobs now and for the future* [Blog} The New York Public Library. https://www.nypl.org/blog/2013/04/02/us-department-commerce-stem-good-jobs-now-and-future

Charlton, L. (2019, December 9). *Study examines why Black Americans remain scarce in executive suites.* The New York Times. https://www.nytimes.com/2019/12/09/us/black-in-corporate-america-report.html

Choudhury, S. (2001). Racial and ethnic differences in wealth and asset choices. *Social Security Bulletin*, *64*(4). https://www.ssa.gov/policy/docs/ssb/v64n4/v64n4p1.html

Christen, A. (2009). Transforming the classroom for collaborative learning in the 21st century. *Techniques: Connecting Education and Careers (J1)*, *84*(1), 28–31. https://eric.ed.gov/?id=EJ829507

Chuah, S.-H. (2010, October). *Teaching East-Asian students: Some observations | The economics network*. The Economics Network. https://www.economicsnetwork.ac.uk/showcase/chuah_international

Chuck, E. (2018, May 11). *How training doctors in implicit bias could save black mothers' lives*. NBC News. https://www.nbcnews.com/news/us-news/how-training-doctors-implicit-bias-could-save-lives-black-mothers-n873036

Clay, R. A. (2017). Did you really just say that? *American Psychological Association*, *45*(1), 46. https://www.apa.org/monitor/2017/01/microaggressions

Committee for Economic Development of the Conference Board (2019, October 30). *Growing the American workforce* [Report]. Committee for Economic Development of the Conference Board. https://www.ced.org/reports/growing-the-american-workforce

Collins, D. E. (2018, February 7). *Black history is U. S. history-but some of my students don't want to hear it.* The Washington Post. https://www.washingtonpost.com/news/posteverything/wp/2018/02/07/black-history-is-u-s-history-but-some-of-my-students-dont-want-to-hear-it/

Collins, K. H. (2018). Confronting color-blind STEM talent development: Toward a contextual model for Black student STEM identity. *Journal of Advanced Academics*, *29*(2), 143–168. https://doi.org/10.1177/1932202X18757958

Columbia News. (2018, October 18). *University report makes recommendations to address gender, race disparities among faculty* [Report]. Columbia News. https://news.columbia.edu/news/university-report-makes-recommendations-address-gender-race-disparities-among-faculty

Columbia University Policy and Planning Committee Equity Reports (2018). *Columbia-arts and sciences PPC Equity Reports 2018.pdf,* (p. 151). Columbia University. https://fas.columbia.edu/files/fas/content/Columbia-ArtsandSciences-PPC-Equity-Reports-2018.pdf

Colvin, G. (2008). *Talent is overrated: What really separates world-class performers from everybody else.* Portfolio publishers.

Conus, X., & Fahrni, L. (2019). Routine communication between teachers and parents from minority groups: An endless misunderstanding? *Education Review*, *71*(2), 234–256. https://doi.org/10.1080/00131911.2017.1387098

Cooper, C. W. (2009). Parent involvement, African American mothers, and the politics of educational care: Equity & excellence in education. *Equity & Excellence in Education*, *42*(4), 379–394. https://doi.org/10.1080/10665680903228389

Corbett, C., & Hill, C. (2015). *Solving the equation: The variables for women's success in engineering and computing. Executive Summary*. American Association of University Women. https://eric.ed.gov/?id=ED580805

Costello, M., & Dillard, C. (2019). Assessing and interrupting intolerance at school. *American*

Educator, *43*(3), 4–7. https://files.eric.ed.gov/fulltext/EJ1231536.pdf

Coyle, D. (2012). *The little book of talent: 52 tips for improving skills*. Bantam Books. http://danielcoyle.com/little-book-talent/

Crandall, J., & Garcia, G. A. (2016, July 27). "Am I overreacting?" Understanding and combating microaggressions *Higher Education Today*. https://www.higheredtoday.org/2016/07/27/understanding-and-combatting-microaggressions-in-postsecondary-education/

Creswell, J. W., & Plano Clark, V. L. (2011). *Designing and conducting mixed methods research* (2nd Edition). SAGE Publications, Inc.

Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.

Curtis, M. C. (2017, January 22). *Judith Brown Dianis is "stepping to the front" in the fight for racial justice.* https://www.nbcnews.com/news/nbcblk/judith-browne-dianis-advancement-project-fight-racial-justice-n648491

Danek, J., & Borrayo, E. (2012). *Developing a health workforce that meets community needs* [Report]. (pp. 1–36). https://community-wealth.org/

Darling-Hammond, L. (2001). Inequality in teaching and schooling: How opportunity is rationed to students of color in America. In B. D. Smedley, L. Colburn, et al. (Eds.), *The right thing to do, the smart thing to do: Enhancing diversity in the health professions: Summary of the symposium on diversity in health professions in honor of Herbert W. Nickens, M.D.* National Academies Press (US). https://www.ncbi.nlm.nih.gov/books/NBK223640/

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020).

Implications for educational practice of the science of learning and development. *Applied Developmental Science*, *24*(2), 97–140. https://doi.org/10.1080/10888691.2018.1537791

Davis, J. (2018). Redefining Black students' success and high achievement in mathematics education: Toward a liberatory paradigm. *Journal of Urban Mathematics Education, 11*(1-2), 9. https://doi.org/10.21423/jume-v11i1-2a359

Day, J. C., & Newburger, E. C. (2002). *The big payoff: Educational attainment and synthetic estimates of work-life earnings* [Report P23-210]. (p. 13). U. S. Census Bureau. https://www.census.gov/prod/2002pubs/p23-210.pdf

DeOrnellas, S. (2015, March 9). From curious little girl to household breadwinner [Blog]. *AAUW* https://ww3.aauw.org/2015/03/09/stephanie-engineering-and-cybersecurity/

DePaul University. (2019). *Defining diaspora*. Center for Black Diaspora. https://las.depaul.edu/centers-and-institutes/center-for-black-diaspora/about/Pages/defining-diaspora.aspx

DeRuy, E. (2016, April 1). *White teachers expect less than Black teachers from Black students*. The Atlantic. https://www.theatlantic.com/education/archive/2016/04/White-teachers-expect-less-than-black-teachers-from-black-students/476307/

DeSilver, D. (2013, August 30). Black incomes are up, but wealth isn't. *Pew Research Center*. http://pewrsr.ch/17reQWa

DeSilver, D. (2017). U.S. academic achievement lags that of their peers in many other countries. *Pew Research Center*. https://www.pewresearch.org/fact-tank/2017/02/15/u-s-students-internationally-math-science/

DeSilver, D. (2019). Internationally, U. S. stands in middle of pack on science, math, reading scores. *Pew Research Center*. https://www.pewresearch.org/fact-tank/2017/02/15/u-s-

students-internationally-math-science/ft_17-02-14_stem_dot-2/

Dillon, S. (2010, September 13). Racial disparity in school suspensions. *The New York Times*. https://www.nytimes.com/2010/09/14/education/14suspend.html

Douglass, S., Mirpuri, S., English, D., & Yip, T. (2016). "They were just making jokes": Ethnic/racial teasing and discrimination among adolescents. *Cultural Diversity and Ethnic Minority Psychology*, *22*(1), 69–82. https://doi.org/10.1037/cdp0000041

Drash, W. (2016, March 24). *"Vicious cycle": Jobless and black in America*. CNN http://www.cnn.com/2010/LIVING/wayoflife/03/24/black.america.study/index.html

Duckworth, A., Matthews, M. D., Peterson, C., & Kelly, D. (2007). Grit: Perseverance and passion for long-term goals. *Journal of Personality and Social Psychology*, *92*(6), 1087–1101. https://doi.org/10.1037/0022-3514.92.6.1087

Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., … & Japel, C. (2007). School readiness and later achievement. *Developmental Psychology*, *43*(6), 1428–1446. https://doi.org/10.1037/0012-1649.43.6.1428

Duncan, G. J., & Magnuson, K. A. (2005). Can family socioeconomic resources account for racial and ethnic test score gaps? *The Future of Children*, *15*(1), 35–54. https://doi.org/10.1353/foc.2005.0004

Ed Data. (2020, July 1). *EdData—School Profile—Fairfax senior high*. Ed Data - Education Data Partnership. http://www.ed-data.org/school/Los-Angeles/Los-Angeles-Unified/Fairfax-Senior-High

History Channel. (2021, May 13). *Brown v. Board of Education*. https://www.history.com/topics/black-history/brown-v-board-of-education-of-topeka

Education Post. (2018). *Black parents want to be involved but schools need to be more*

welcoming. YouTube. https://www.youtube.com/watch?v=wPUVM0VGMZY

English, D., Lambert, S. F., Tynes, B. M., Bowlet, L., Zea, M. C., & Howard, L. C. (2020). Daily multidimensional racial discrimination among Black U.S. American adolescents. *Journal of Applied Developmental Psychology*, *66*. https://doi.org/10.1016/j.appdev.2019.101068

Escobar, N. (2016, February 9). *Report: Black students underrepresented in high-paying STEM majors.* U. S. News & World Report. https://www.usnews.com

Estrada, M., Burnett, M., Campbell, A. G., Campbell, P. B., Denetclaw, W. F., Gutiérrez, C. G., … & Zavala, M. (2016). Improving underrepresented minority student persistence in STEM. *CBE Life Sciences Education*, *15*(3). https://doi.org/10.1187/cbe.16-01-0038

Faust, D. G. (2020). *White Southern responses to Black emancipation.* American Experience, PBS. https://www.pbs.org/wgbh/americanexperience/features/reconstruction-White-southern-responses-black-emancipation/

Feagin, J. R., & Sikes, M. P. (1995). How Black students cope with racism on White campuses. *The Journal of Blacks in Higher Education*, *8*, 91–97. https://doi.org/10.2307/2963064

Fensterwald, J. (2019, November 22). *California is poised to confront high proportions of underqualified teachers in low-income schools* . EdSource. https://edsource.org/2019/california-is-poised-to-confront-high-proportions-of-underqualified-teachers-in-low-income-schools/620402

Figueroa, T., Hurtado, S., & Wilkins, A. (2015). *Black STEM students and the opportunity structure [Report].* Association for Institutional Research. https://www.heri.ucla.edu/nih/downloads/AIR2015-Black-STEM-Students-and-the-Opportunity-Structure.pdf

Flanagan, L. (2019, May 27). *Going for depth: How schools and teachers can foster meaningful*

learning experiences. KQED. https://www.kqed.org/mindshift/53684

Flannery, M. E. (2015). Thought & action—Equity, diversity & social justice. *The NEA Higher Education Journal*, *31*(2), 7-8. https://vtechworks.lib.vt.edu/

Folger, J. (2021, June 23). *Why knowing your net worth is important.* Investopedia. https://www.investopedia.com/articles/pf/13/importance-of-knowing-your-net-worth.asp

Freedberg, L. (2018, April 27). *Despite progress, California's teaching force far from reflecting diversity of students.* EdSource. https://www.dailynews.com/despite-progress-californias-teaching-force-far-from-reflecting-diversity-of-students

Freeman, K. (1999). HBCs or PWIs? African American high school students' consideration of higher education institution types. *The Review of Higher Education*, *23*(1), 91–106. https://doi.org/10.1353/rhe.1999.0022

Funk, C., & Parker, K. (2018, January 8). *Women and men in STEM often at odds over workplace equity.* https://www.pewsocialtrends.org/2018/01/09/blacks-in-stem-jobs-are-especially-concerned-about-diversity-and-discrimination-in-the-workplace/

Gaertner, S. L., & Dovidio, J. F. (2000). The aversive form of racism. In C. Stangor (Ed.), *Stereotypes and prejudice: Essential readings* (pp. 289–304). Psychology Press.

Gall, M., Borg, W., & Gall, J. (1996). *Educational research: An introduction*. Longman.

Garcia, E. (2015). *Inequalities at the starting gate* [Report]. Economic Policy Institute. https://www.epi.org/publication/inequalities-at-the-starting-gate-cognitive-and-noncognitive-gaps-in-the-2010-2011-kindergarten-class/

Garcia, E., & Weiss, E. (2017). *Reducing and averting achievement gaps: Key findings from the report 'Education inequalities at the school starting gate' and comprehensive strategies to mitigate early skills gaps* [Policy brief]. Economic Policy Institute (pp. 1–29).

https://www.epi.org/publication/reducing-and-averting-achievement-gaps/

Garcia, E., & Weiss, E. (2019, March 26). *The teacher shortage is real, large and growing, and worse than we thought: The first report in the Perfect Storm in the Teacher Labor Market series* [Report]. Economic Policy Institute. https://www.epi.org/publication/the-teacher-shortage-is-real-large-and-growing-and-worse-than-we-thought-the-first-report-in-the-perfect-storm-in-the-teacher-labor-market-series/

Garland, S. (2012, July 25). Rich kid, poor kid: How mixed neighborhoods could save America's schools. *The Atlantic*. https://www.theatlantic.com/national/archive/2012/07/rich-kid-poor-kid-how-mixed-neighborhoods-could-save-americas-schools/260308/

Gay, G. (2010). *Culturally responsive teaching: Theory, research, and practice*. Teachers College Press. https://eric.ed.gov/?id=ED581130

Gay, G., & Howard, T. (2000). Multicultural teacher education for the 21st century. *The Teacher Educator*, *36*(1), 1–16. https://doi.org/10.1080/08878730009555246

Gay, G., & Kirkland, K. (2003). Developing cultural critical consciousness and self-reflection in preservice teacher education. *Theory into Practice*, *42*(3), 181–187. https://doi.org/10.1207/s15430421tip4203_3

Gee, J. (1989). What is literacy? *Journal of Education*, *171*(1), 18–25. https://eric.ed.gov/?id=EJ399919

Gee, J. (2004). Language in the science classroom: Academic social languages as the heart of school-based literacy. In R. Yerrick & W. M. Roth (Eds.), *Establishing scientific discourse communities: Multiple voices of teaching and research* (pp. 19–38). Lawrence Erlbaum Publishers.

Gershenson, S. (2015, August 18). The alarming effect of racial mismatch on teacher

expectations. *Brookings*. https://www.brookings.edu/blog/brown-center-chalkboard/2015/08/18/the-alarming-effect-of-racial-mismatch-on-teacher-expectations/

Gershenson, S., Holt, S. B., & Papageorge, N. W. (2015). *Who believes in me? The effect of student-teacher demographic match on teacher expectations* [Working paper]. W.E. Upjohn Institute for Employment Research, 15-231. https://doi.org/10.17848/wp15-231

Gilliam, W. S., Maupin, A. N., Reyes, C. R., Accavitti, M., & Shic, F. (2016). *Do early educators' implicit biases regarding sex and race relate to behavior expectations and recommendations of preschool expulsions and suspensions* [Research brief]*?* Yale Child Study Center. https://medicine.yale.edu/childstudy/zigler/publications/Preschool%20Implicit%20Bias%20Policy%20Brief_final_9_26_276766_5379_v1.pdf

Gladden-Young, A. (2020, June 13). Give black scientists a place in this fight. *The Atlantic*. https://www.theatlantic.com/ideas/archive/2020/06/give-black-scientists-place-fight/613021/

Glaser, A. (2020, May 13). *Current and ex-employees allege Google drastically rolled back diversity programs*. NBC News. https://www.nbcnews.com/news/us-news/current-ex-employees-allege-google-drastically-rolled-back-diversity-inclusion-n1206181

Glenza, J. (2016, January 3). *Rosewood Massacre a harrowing tale of racism and the road toward reparations*. The Guardian. http://www.theguardian.com/us-news/2016/jan/03/rosewood-florida-massacre-racial-violence-reparations

Goff, P. A., Jackson, M. C., Di Leone, B. A. L., Culotta, C. M., & DiTomasso, N. A. (2014). The essence of innocence: Consequences of dehumanizing Black children. *Journal of Personality and Social Psychology*, *106*(4), 526–545. https://doi.org/10.1037/a0035663

Graham, E. (2015, September 2). *School suspensions and the racial discipline gap*. JSTOR Daily. https://daily.jstor.org/school-suspensions-racial-discipline-gap/

Greenberg, J., Pomerance, L., & Walsh, K. (2011). Student teaching in the United States. *National Council on Teacher Quality*. www.nctq.org/edschoolreports/studentteaching

Grinberg, E. (2015, November 25). *4 ways you might be displaying hidden bias in everyday life*. Race & Reality IN AMERICA. https://www.cnn.com/2015/11/24/living/implicit-bias-tests-feat/index.html

Grissom, J. A., & Redding, C. (2016). Discretion and disproportionality: Explaining the underrepresentation of high-achieving students of color in gifted programs. *AERA Open, 2*(1). https://doi.org/10.1177/2332858415622175

Guy, S. (2020, January 23). Surviving and thriving: Why women pursue and stay in engineering. *SWE Magazine.* Society of Women Engineers. https://alltogether.swe.org/2020/01/discovere-why-women-pursue-and-stay-in-engineering/

Hamilton, L. S., Stecher, B. M., & Klein, S. P. (Eds.) (2002). *Making sense of test-based accountability in education* [Monograph]. Rand Education. https://www.rand.org/content/dam/rand/pubs/monograph_reports/2002/MR1554.pdf

Hammerness, K., Darling-Hammond, L., Bransford, J., Berliner, D., Cochran-Smith, M., McDonald, M., & Zeichner, K. (2005). How teachers learn and develop," in L. Darling-Hammond, and J. Bransford (Eds.), *Preparing teachers for a changing world: What teachers should learn and be able to do,* (pp. 358–389). Jossey-Bass.

Hammond, L., & Brandt, C. (2004). *Science and cultural process: Defining an anthropological approach to science education*. https://www.csus.edu/indiv/h/hammondl/anthscifinal4-

19-04.htm

Hanauer, N. (2019, July). Better public schools won't fix America. The Atlantic. https://www.theatlantic.com/magazine/archive/2019/07/education-isnt-enough/590611/

Hanks, A., Solomon, D., & Weller, C. E. (2018, February 21). *Systematic inequality*: *How America's structure racism helped create the Black-White wealth gap.* Center for American Progress. https://www.americanprogress.org/issues/race/reports/2018/02/21/447051/systematic-inequality/

Hanover Research. (2017). *School-based strategies for narrowing the achievement gap*[Report] (p. 45). Hanover Research. www.hanoverresearch.com

Hanushek, E. A., & Rivkin, S. G. (2008). Harming the best: How schools affect the Black-White achievement gap. *Journal of Policy Analysis and Management, 28*(3), 366-393. https://doi.org/10.1002/pam.20437

Harmon, A. (2019, February 18). *For a Black mathematician, what it's like to be the 'only one.'* The New York Times. https://www.nytimes.com/2019/02/18/us/edray-goins-black-mathematicians.html?smid=url-share

Harper, S.R., & Hurtado, S. (2007). Nine themes in campus racial climates and implications for institutional transformation. *New Directions for Student Services*, (120), 7-24. https://doi.org/10.1002/ss.254

Harper, C. (2018, May 14). *HBCUs, Black women, and STEM success*. Blog. Higher Education Today. https://www.higheredtoday.org/2018/05/14/hbcus-black-women-stem-success/

Harris, A. (2019, March 20). *New York City high schools' endless segregation problem*. The Atlantic. https://www.theatlantic.com/education/archive/2019/03/stuyvesant-high-

schools-chronic-lack-black-students/585349/

Harrison, C., & Tanner, K. D. (2018, March 1). Language matters: Considering microaggressions in science. *CBE Life Sciences Education*, *17*(1). https://doi.org/10.1187/cbe.18-01-0011

HASPI. (2006). *Health and Science Pipeline Initiative*. Health and Science Pipeline Initiative. http://www.haspi.org/

Henderson, A. T., & Mapp, K. L. (2002). *A new wave of evidence: The impact of school, family, and community connections on student achievement. Annual synthesis, 2002* [Analysis]. National Center for Family & Community Connections with Schools, Southwest Educational Development Laboratory. https://eric.ed.gov/?id=ED474521

Hess, J. L., Sorge, B., & Feldhaus, C. (2016, June 26-29). *The efficacy of Project Lead the Way: A systematic literature review* [Paper presentation]. ASEE'S 123rd Annual Conference & Exposition, New Orleans, LA. https://doi.org/10.18260/p.26151

Hill, N. E., Castellino, D. R., Lansford, J. E., Nowlin, P., Dodge, K. A., Bates, J. E., & Pettit, G. S. (2004). Parent academic involvement as related to school behavior, achievement, and aspirations: Demographic variations across adolescence. *Child Development*, *75*(5), 1491-1509. https://doi.org/10.1111/j.1467-8624.2004.00753.x

Hill, S. (2018, February 12). *Little known Black history facts: This 87-year-old black woman helped develop GPS technology*. Black Enterprise. https://www.blackenterprise.com/little-known-black-history-facts-87-year-old-black-woman-helped-develop-gps-technology/

History.com Editors (2018, March 8). *Tulsa Race Massacre*. HISTORY. https://www.history.com/topics/roaring-twenties/tulsa-race-massacre

Hoffman, E., Starobin, S., Laanan, F., & Rivera, M. (2010). Role of community colleges in STEM education: Thoughts on implications for policy, practice, and future research. *Journal of Women and Minorities in Science and Engineering*, *16*, 85–96. https://doi.org/10.1615/JWomenMinorScienEng.v16.i1.60

Hom, E. J. (2014, February 11). *What is STEM education?* Livescience.Com. https://www.livescience.com/43296-what-is-stem-education.html

Horowitz, J. M., Brown, A., & Cox, K. (2019, April 9). *Race in America 2019*. Pew Research Center. https://www.pewsocialtrends.org/2019/04/09/race-in-america-2019/

Howard, T. C., & Reynolds, R. (2008). Examining parent involvement in reversing the underachievement of African American students in middle-class schools. *Educational Foundations*, *22*(1–2), 20. https://eric.ed.gov/?id=EJ839499

Huseman, R. C., Hatfield, J. D., & Miles, E. W. (1987). A new perspective on equity theory: The equity sensitivity construct. *The Academy of Management Review*, *12*(2), 222–234. https://doi.org/10.2307/258531

HWI (2020). *Health workforce initiative*. Health Workforce Initiative. https://ca-hwi.org/career-pathways/haspi

Indiana Department of Education (2021, August 19). *Approved transition to teaching programs.* https://www.in.gov/doe/educators/educator-licensing/approved-transition-to-teaching-programs/

James, R., Starks, H., Segrest, V., & Burke, W. (2012). From leaky pipeline to irrigation system: Minority education through the lens of community-based participatory research. *Progress in Community Health Partnerships: Research, Education, and Action*, *6*(4), 471–479. https://doi.org/10.1353/cpr.2012.0055

Jaschik, S. (2013, January 14). *Study finds that increased parental support for college results in lower grades*. INSIDE HIGHER ED. https://www.insidehighered.com/news/2013/01/14/study-finds-increased-parental-support-college-results-lower-grades

Jaschik, S. (2015, September 3). *SAT scores drop.* INSIDE HIGHER ED. https://www.insidehighered.com/news/2015/09/03/sat-scores-drop-and-racial-gaps-remain-large

Journal of Blacks in Higher Education (2008). *More Blacks are competing in Advanced Placement Programs, but the racial scoring gap is widening*.. http://www.jbhe.com/features/59_apscoringgap.html

Journal of Blacks in Higher Education (2019, May 19). *Black student college graduation rates remain low, but modest progress begins to show* [Education]. The Journal of Blacks in Higher Education. http://www.jbhe.com/features/50_blackstudent_gradrates.html

Jencks, C., & Phillips, M. (1998, March 1). The Black-White test score gap: Why it persists and what can be done. *Brookings Institute*. https://www.brookings.edu/articles/the-black-White-test-score-gap-why-it-persists-and-what-can-be-done/

Johnson, A., & Harrison, M. (2017, February 6). *How to recruit and retain underrepresented minorities. American Scientist, 104*(76). https://doi.org/10.1511/2016.119.76

Johnson, E. (2019a, October 18). *Racial inequality, at college and in the workplace*. INSIDE HIGHER ED. https://www.insidehighered.com/quicktakes/2019/12/09/uc-berkeley-condemns-racist-video#.YR6rKf-OXl4.link

Johnson, E. (2019b, December 9). *UC Berkeley condemns racist video*. INSIDE HIGHER ED. https://www.insidehighered.com/quicktakes/2019/12/09/uc-berkeley-condemns-racist-

video

Jones, R. M. (2015, March 24). *President Obama on STEM Education.* American Institute of Physics. https://www.aip.org/fyi/2015/president-obama-stem-education

Johnson, K. V., & Watson, E. D. (2005). A historical chronology of the plight of African Americans gaining recognition in engineering and technology. *Journal of Technology Studies*, *31*(2), 81–93. https://eric.ed.gov/?id=EJ848441

Jones, V., & Jones, L. (2007). *Comprehensive classroom management: Creating communities of support and solving problems.* Laureate Education.

Joseph, B. (2018, November 12). STEM and Blacks. *Diverse: Issues in Higher Education, a CMA Publication*. https://diverseeducation.com/article/131698/

Katz, J. R., Barbosa-Lekier, C., & Benavides-Vaello, S. (2016). Measuring the success of a pipeline program to increase nursing workforce diversity. *Journal of Professional Nursing*, *32*(1), 6–14. https://doi.org/10.1016/j.profnurs.2015.05.003

Killpack, T. L., & Melón, L. C. (2016). Toward inclusive STEM classrooms: What personal role do faculty play? *CBE Life Sciences Education*, *15*(3), 1-9. https://doi.org/10.1187/cbe.16-01-0020

Kirchherr, J., & Charles, K. (2018, August 22). Enhancing the sample diversity of snowball samples: Recommendations from a research project on anti-dam movements in Southeast Asia. *PLoS ONE*, *13*(8). https://doi.org/10.1371/journal.pone.0201710

Kirwan Institute for the Study of Race and Ethnicity (2021). *Implicit Bias Training Module Series.* http://kirwaninstitute.osu.edu/implicit-bias-training/

Klein, A. (2015a, March 31). *ESEA's 50-year legacy a blend of idealism, policy tensions.* Education Week. https://www.edweek.org/ew/articles/2015/04/01/eseas-50-year-legacy-

a-blend-of-idealism.html

Klein, A. (2015b, April 10). *No Child Left Behind: Overview.* Education Week. https://www.edweek.org/ew/section/multimedia/no-child-left-behind-overview-definition-summary.html

Kochhar, R., & Fry, R. (2014, December 12). *Wealth inequality has widened along racial, ethnic lines since end of Great Recession.* Pew Research Center. http://pewrsr.ch/1yImF75

Kramer, A. (2020, January 7). *Recognizing workplace challenges faced by Black women leaders.* Forbes. https://www.forbes.com/sites/andiekramer/2020/01/07/recognizing-workplace-challenges-faced-by-black-women-leaders/#68805b8253e3

Krupnick, M. (2018, October 2). Despite promises, hiring of Black faculty at White colleges declined. *The Hechinger Report*. https://hechingerreport.org/after-colleges-promised-to-increase-it-hiring-of-black-faculty-declined/

Kutlu, Ö., & Kartal, S. K. (2018). The prominent student competences of the 21st century education and the Transformation of classroom assessment. *International Journal of Progressive Education*, *14*(6), 70–82. https://doi.org/10.29329/ijpe.2018.179.6

Ladson-Billings, G. (1995). But that's just good teaching! The case for culturally relevant pedagogy. *Theory in Practice, 34*(3), 159–165. https://doi.org/10.1080/00405849509543675

Ladson-Billings, G. (2006). From the achievement gap to the education debt: Understanding achievement in U.S. schools. *Educational Researcher*, *35*(7), 3–12. https://doi.org/10.3102%2F0013189X035007003

Ladson-Billings, G. (2015, April 8). Critical race theory and education-short [YouTube]. https://www.youtube.com/watch?v=katwPTn-nhE

LaFrance, A., & Newkirk, V. R. (2017, August 12). The lost history of an American coup D'État. *The Atlantic*. https://www.theatlantic.com/politics/archive/2017/08/wilmington-massacre/536457/

Lam, L. (2019, October 16). Fact sheet: A design for workforce equity. *Center for American Progress*.

Landivar, L. C. (2013). *Disparities in STEM employment by sex, race, and Hispanic origin* (Report ACS-24). U. S. Census Bureau. https://www2.census.gov/library/publications/2013/acs/acs-24.pdf

Langdon, D., McKittrick, G., Beede, D., Khan, B., & Doms, M. (2011, Jully). *STEM: Good jobs now and for the future* [ESA Issue Brief #03-11]. U. S. Department of Commerce. https://eric.ed.gov/?id=ED522129

Lazio, R., & Ford Jr., H. (2019, June 6). *The U. S. needs to prepare workers for STEM jobs* SHRM. https://www.shrm.org/hr-today/news/hr-magazine/summer2019/pages/the-u.s.-needs-to-prepare-workers-for-stem-jobs.aspx

Lee, J. A. (2018). Affirmation, support, and advocacy: Critical race theory and academic advising. *NACADA Journal*, *38*(1), 77–87. https://doi.org/10.12930/NACADA-17-028

Lee, T. (2019, August 14). *How America's vast racial wealth gap grew: By plunder*. The New York Times. https://www.nytimes.com

Lin, Y., & Vogt, W. P. (1996). Occupational outcomes for students earning two-year college degrees: Income, status, and equity. *The Journal of Higher Education, 67*(4), 446–475. https://doi.org/10.1080/00221546.1996.11780269

Liu, J. (2020, June 5). *Talking about racial inequality at work is difficult--here are tips to do it thoughtfully*. Make It. https://www.cnbc.com/2020/06/05/how-to-thoughtfully-talk-about-

racial-inequality-with-your-coworkers.html

Love, D. (2015, September 22). *Group economics is the key to the destiny of Black people* [National]. Atlantic Black Star. https://atlantablackstar.com/2015/09/22/group-economics-key-destiny-black-people/

Mahnken, K. (2018, August 15). *Why diversity Matters: Five things we know about how Black students benefit from having Black teachers*. The 74. https://www.the74million.org/

Malik, R. (2017a, March 30). *4 Disturbing facts about preschool suspension*. Center for American Progress. https://www.americanprogress.org/issues/early-childhood/news/2017/03/30/429552/4-disturbing-facts-preschool-suspension/

Malik, R. (2017b, November 6). *New data reveal 250 preschoolers are suspended or expelled every day*. Center for American Progress. https://www.americanprogress.org/issues/early-childhood/news/2017/11/06/442280/new-data-reveal-250-preschoolers-suspended-expelled-every-day/

Manrique, M. S., & Sánchez Abchi, V. (2015). Teachers' practices and mental models: Transformation through reflection on action. *Australian Journal of Teacher Education*, *40*(6). https://eric.ed.gov/?id=EJ1064613

Martin, D. B., & McGee, E. O. (2009). Mathematics literacy and liberation: Reframing mathematics education for African American children. In B. Greer, S. Mukhopadhyay, A. B. Powell, & S. Nelson-Barber (Eds.), *Culturally responsive mathematics education*. Routledge.

Marx, D. M., & Stapel, D. A. (2006). Understanding stereotype lift: On the role of the social self. *Social Cognition*, *24*(6), 776–792. https://doi.org/10.1521/soco.2006.24.6.776

McBride, A. (2006, December). *The Supreme Court. The first hundred years. Landmark cases.*

Plessy v. Ferguson (1896) | PBS. Thirteen Media with Impact. https://www.thirteen.org/wnet/supremecourt/antebellum/landmark_plessy.html

McFadden, L., & Bush Koch, D. (2016, September 30). *Parenting is educating*. US News & World Report. https://www.usnews.com/opinion/articles/2016-09-30/how-parents-can-become-advocates-for-their-childrens-education

McGee, E. O. (2013). High-achieving Black students, biculturalism, and out-of-school STEM learning experiences: Exploring some unintended consequences. *Journal of Urban Mathematics Education*, *6*(2), 20–41. https://eric.ed.gov/?id=EJ1085783

McGee, E., & Spencer, M. B. (2015). Black parents as advocates, motivators, and teachers of mathematics. *The Journal of Negro Education*, *84*(3), 473-490. https://doi.org/10.7709/jnegroeducation.84.3.0473

McGeehan, P. (2012, June 20). *Blacks miss out as jobs rebound in New York City*. The New York Times. https://www.nytimes.com

McIntosh, K., Moss, E., Nunn, R., & Shambaugh, J. (2020, February 27). Examining the Black-White wealth gap. *Brookings*. https://www.brookings.edu/blog/up-front/2020/02/27/examining-the-black-White-wealth-gap/

McIntosh, P. (2019). White privilege: Unpacking the invisible knapsack (1989) 1. In P. McIntosh, *On privilege, fraudulence, and teaching as learning* (1st ed., pp. 29–34). Routledge. https://doi.org/10.4324/9781351133791-4

McKown, C. (2013). Social equity theory and racial-ethnic achievement gaps. *Child Development*, *84*(4), 1120–1136. https://doi.org/10.1111/cdev.12033

Mervosh, S., Harmon, A., & Bogel-Burroughs, N. (2019, December 21). *These reporters lost their jobs. Here are the stories they couldn't tell.* The New York Times.

https://www.nytimes.com

Merriam-Webster (2020, October 6). *Positive feedback.* [Definition]. https://www.merriam-webster.com/dictionary/positive%20feedback

Merriam-Webster (2020). *Racism*. https://www.merriam-webster.com/dictionary/racism

Merriam-Webster (2021, February 25). *Definition of shepherd*. https://www.merriam-webster.com/dictionary/shepherd

Montpas, A. M. (2019). *African American parent perspectives on positive relationships with their children's teachers* [Doctoral dissertation]. The University of Wisconsin-Madison. https://search.proquest.com/openview/6eb777862c70fc2ae5db93a1a4f6a82a/1?pq-origsite=gscholar&cbl=18750&diss=y

Moran, K. (2018, June 25). 13 tired education buzzwords to stop using now. *MDR*. https://mdreducation.com/2018/06/25/13-tired-education-buzzwords/

Morgan, T. (2020, February 4). *8 Black inventors who made daily life easier*. HISTORY Channel. https://www.history.com/news/8-black-inventors-african-american

Morrell, C., & Parker, C. (2013, April 2). *Adjusting micromessages to improve equity in STEM*. *Diversity & Democracy, 16*(2). Association of American Colleges & Universities. https://www.aacu.org/publications-research/periodicals/adjusting-micromessages-improve-equity-stem

Muhammad, G. (2020). *Cultivating genius: An equity framework for culturally and historically responsive literacy*. Scholastic Inc.

Munce, R., & Fraser, E. (2012). *Where are the STEM Students? What are their career interests? Where are the STEM jobs* [Report]*?* STEMconnector. https://www.dailyherald.com/assets/PDF/DA127758822.pdf

Muro, M., Berube, A., & Whiton, J. (2018, March 28). Black and Hispanic underrepresentation in tech: It's time to change the equation. *Brookings*. https://www.brookings.edu/

Musu-Gillette, L., Robinson, J., McFarland, J., KewalRamani, A., Zhang, A., & Wilkinson-Flicker, S. (2016). *Status and trends in the education of racial and ethnic groups 2016* [NCES 2016-007]. U. S. Department of Education. https://nces.ed.gov/pubs2016/2016007.pdf

Nance, J. P. (2016). *Students, police, and the school-to-prison pipeline*. UF Law Faculty Publications. https://scholarship.law.ufl.edu/ facultypub/766

Nathan, M. J., Atwood, A. K., Prevost, A., Phelps, L. A., & Tran, N. A. (2011). How professional development in Project Lead the Way changes high school STEM teachers' beliefs about engineering education. *Journal of Pre-College Engineering Education Research*, *1*(1), 15–29. https://doi.org/10.7771/2157-9288.1027

National Academies of Sciences, Engineering, and Medicine (2016). The culture of undergraduate STEM education. In S. Malcom and M. Feder (Eds.) *Barriers and opportunities for 2-Year and 4-Year STEM degrees: Systemic change to support students' diverse pathways*. National Academies Press (US). https://doi.org/10.17226/21739

National Research Council. (2011). Expanding understanding minority participation: America's science and technology talent at the crossroads. *National Academies Press*. http://www.nap.edu/

National Science Board (2018). *Science and Engineering Indicators 2018* [Digest NSB-2018-2]. https://www.nsf.gov/statistics/indicators/

National Science Board. (2018). *Science and Engineering Indicators 2018* [Digest NSB-2018-2]. Chapter 3. https://www.nsf.gov/statistics/indicators/

Nicholson-Crotty, S., Grissom, J. A., Nicholson-Crotty, J., & Redding, C. (2016). Disentangling the causal mechanisms of representative bureaucracy: Evidence from assignment of students to gifted programs. *Journal of Public Administration Research and Theory*, *26*(4), 745–757. https://doi.org/10.1093/jopart/muw024

Niemiec, C. P., & Ryan, R. M. (2009). Autonomy, competence, and relatedness in the classroom: Applying self-determination theory to educational practice. *Theory and Research in Education*, *7*(2), 133–144. https://doi.org/10.1177/1477878509104318

Noonan, R. (2017). STEM jobs: 2017 Update [ESA Issue Brief #02-17]. *U.S. Department of Commerce Economics and Statistics Administration, Office of the Chief Economist*. https://eric.ed.gov/?id=ED594354

Novoa, C., & Hamm, K. (2017, October 31). *The cost of inaction on universal preschool*. Center for American Progress. https://www.americanprogress.org/issues/early-childhood/news/2017/10/31/441825/the-cost-of-inaction-on-universal-preschool/

Odemwingie, M. (2018, April 26). *A teacher said something biased. I struggled with how to respond.* ANet blog. Achievement Network. https://www.achievementnetwork.org/anetblog/calling-out-bias

Office for Civil Rights (1991, March) *Historically Black colleges and universities and higher education desegregation* US Department of Education;. https://www2.ed.gov/about/offices/list/ocr/docs/hq9511.html

Office for Civil Rights, U. (2014). *Civil right data collection: Data snapshot school discipline*. US Department of Education. https://www2.ed.gov/about/offices/list/ocr/docs/crdc-discipline-snapshot.pdf?utm_source=JFSF+Newsletter&utm_campaign=0f6e101c7e-Newsletter_July_2013&utm_medium=email&utm_term=0_2ce9971b29-0f6e101c7e-

195307941

Ogawa, M. (1995). Science education in a multiscience perspective. *Science Education*, *79*(5), 583–593. https://doi.org/10.1002/sce.3730790507

Ogletree, C. J. (2004, April 12). *All deliberate speed*. Center for American Progress. https://www.americanprogress.org/issues/general/news/2004/04/12/660/all-deliberate-speed/

Onosko, J. (2011). Race to the Top leaves children and future citizens behind: The devastating effects of centralization, standardization, and high stakes accountability. *Democracy & Education*, *19*(2). https://democracyeducationjournal.org/home/vol19/iss2/1

Onwuachi-Willig, A. (2016, September 16). *Race and racial identity are social constructs*. https://www.nytimes.com/roomfordebate/2015/06/16/how-fluid-is-racial-identity/race-and-racial-identity-are-social-constructs

Organization for Economic Cooperation and Development. (2004). *Problem solving for tomorrow's world: First measures of cross-curricular competencies from PISA 2003*. Paris. https://www.oecd.org

Oshinsky, D. (2017, June 20). *A powerful, disturbing history of residential segregation in America.* The New York Times. https://www.nytimes.com

Oxford Learners Dictionaries (2020). *The American dream* (definition). https://www.oxfordlearnersdictionaries.com/us/definition/english/the-american-dream

Ouimet, M. (2015, May 5). *5 numbers that explain why STEM diversity matters to all of us*. WIRED. https://www.wired.com

Partnership for 21st Century Skills. (2008). *21st century skills, education & competitiveness: A resource and policy guide*. https://files.eric.ed.gov/fulltext/ED519337.pdf

Patrick, S. L., & Jackson, J. J. (1991). Further examination of the equity sensitivity construct. *Perceptual and Motor Skills*, *73*(3 Pt 2), 1091–1106.

Pell, A. N. (1996). Fixing the leaky pipeline: Women scientists in academia. *Journal of Animal Science*, *74*(11), 2843–2848. https://doi.org/10.2527/1996.74112843x

Pennington, C. R., Heim, D., Levy, A. R., & Larkin, D. T. (2016). Twenty years of stereotype threat research: A review of psychological mediators. *PLoS ONE*, *11*(1). https://doi.org/10.1371/journal.pone.0146487

Perkins-Gough, D. (2013). The significance of grit: A conversation with Angela Lee Duckworth. *Educational Leadership*, *71*(1), 14–20. https://eric.ed.gov/?id=EJ1032665

Perna, L., Lundy-Wagner, V., Drezner, N. D., Gasman, M., Yoon, S., Bose, E., & Gary, S. (2008). The contribution of HBCUs to the preparation of African American women for STEM careers: A case study. *Research in Higher Education*, *50*(1), 1–23. https://doi.org/10.1007/s11162-008-9110-y

Perry, A. (2018, July 31). Clusters of Black science majors offer a map for future investment. *The Hechinger Report*. https://hechingerreport.org/clusters-of-black-science-majors-offer-a-map-for-future-investment/

Peteet, B. J., Montgomery, L., & Weekes, J. C (2015). Predictors of imposter phenomenon among talented ethnic minority undergraduate students. *The Journal of Negro Education*, *84*(2), 175–186. https://doi.org/10.7709/jnegroeducation.84.2.0175

Picchi, A. (2019, November 14). *70% of Americans say they are struggling financially*. CBS News. https://www.cbsnews.com/news/70-americans-are-struggling-financially/

Pinder, P. J. (2008). *Cultural, ethnic differences and educational achievement of African heritage students: Towards employing a culturally sensitive curriculum in K-12*

Classrooms: A literature review. https://eric.ed.gov/?id=ED499783

Porter, A. (2020). *Rethinking the achievement gap*. Penn GSE News. Penn State Graduate School of Business. https://www.gse.upenn.edu/news/rethinking-achievement-gap

U. S. Department of Education (2009, July 24). *President Obama, U.S. secretary of education Duncan announce national competition to advance school reform* [Press Release]. https://www2.ed.gov/news/pressreleases/2009/07/07242009.html

Qian, L. (2015, November 18). *Black role models share life experiences, insights to help youth succeed.* Columbia Missourian.

Quick, K. (2018, May 21). *School discipline without racial equity is discrimination*. The Century Foundation. https://tcf.org/content/commentary/school-discipline-without-racial-equity-discrimination/

Quick, K., & Kahlenberg, R. D. (2019). *Attacking the Black–White opportunity gap that comes from residential segregation*. The Century Foundation. https://tcf.org

Quillian, L., Pager, D., Midtbøen, A. H., & Hexel, O. (2017, October 11). *Hiring discrimination against Black Americans hasn't declined in 25 Years*. Harvard Business Review. https://hbr.org/2017/10/hiring-discrimination-against-black-americans-hasnt-declined-in-25-years

Reeves, R. V., & Pulliam, C. (2019, February 14). *No room at the top: The stark divide in black and White economic mobility*. Brookings. https://www.brookings.edu/blog/up-front/2019/02/14/no-room-at-the-top-the-stark-divide-in-black-and-White-economic-mobility/

Richardson, G. (2007). *Why African Americans can't get ahead: And how we can solve it with group economics*. Cushcity Communications.

Richardson, J. M. (1969). Florida Black codes. *The Florida Historical Quarterly*, *47*(4), 365–379.https://stars.library.ucf.edu/fhq

Riegle-Crumb, C., & King, B. (2010). Questioning a White male advantage in STEM: Examining disparities in college major by gender and race/ethnicity. *Educational Researcher*, *39*(9), 656–664. https://doi.org/10.3102/0013189X10391657

Roberts, L. M., & Mayo, A. J. (2019, November 14). Toward a racially just workplace. *Harvard Business Review*. https://hbr.org/2019/11/toward-a-racially-just-workplace

Roche, J. P. (1951). The future of "separate but equal." *Phylon (1940-1956)*, *12*(3), 219–226. Clark Atlanta Universitiy. https://doi.org/10.2307/271632

Ross, J. (2018, November 21). *In every tally of hate crimes, blacks are the most frequent victims*. NBC News. https://www.nbcnews.com/news/nbcblk/every-tally-hate-crimes-blacks-are-most-frequent-victims-n938541

Rothstein, R. (2017). *The color of law: A forgotten history of how our government segregated America*. Liveright. https://www.epi.org/publication/the-color-of-law-a-forgotten-history-of-how-our-government-segregated-america/

Runyowa, S. (2015, September 18). Microaggressions are real. *The Atlantic*. https://www.theatlantic.com/politics/archive/2015/09/microaggressions-matter/406090/

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*, 68–78. https://psycnet.apa.org/doi/10.1037/0003-066X.55.1.68

Sabin, J. T. (2015). Teacher morale, student engagement, and student achievement growth in reading: A correlational study. *Journal of Organizational and Educational Leadership*, *1*(1). https://eric.ed.gov/?q=Teacher+morale&pr=on&ft=on&id=EJ1131517

Safir, S. (2016, March 14). *5 keys to challenging implicit bias*. Edutopia. https://www.edutopia.org/blog/keys-to-challenging-implicit-bias-shane-safir

San Diego STEM Ecosystem. (2020, June). *San Diego STEM role model initiative | San Diego STEM Ecosystem*. SD STEM Ecosystem. https://www.sdstemecosystem.org/role-model

Saylo, M. C., Escoton, C. C., & Saylo, M. M. (2011). Punctuated equilibrium vs. phyletic gradualism. *International Journal of Bio-Science and Bio-Technology*, *3*(4), 16.

Schenke, K., Nguyen, T., Watts, T. W., Sarama, J. H., & Clements, D. H. (2017). Differential effects of the classroom on African American and non-African American's mathematics achievement. *Journal of Educational Psychology*, *109*(6), 794–811. https://doi.org/10.1037/edu0000165

Schiele, J. H. (2002). Mutations of Eurocentric domination and their implications for African American resistance. *Journal of Black Studies*, *32*(4), 439–463. https://doi.org/10.1177%2F002193470203200405

Schmader, T., Johns, M., & Forbes, C. (2008). An integrated process model of stereotype threat effects on performance. *Psychological Review*, *115*(2), 336–356. https://doi.org/10.1037/0033-295X.115.2.336

Schneider, B., Broda, M., Judy, J., & Burkander, K. (2013). Pathways to college and STEM careers: Enhancing the high school experience. *New Directions for Youth Development*, *2013*(140), 9–29. https://doi.org/10.1002/yd.20076

Schwartz, I. (2019). *Eric Holder to Trump: "Exactly when did you think America was great?"* https://www.realclearpolitics.com/video/2019/03/27/eric_holder_to_trump_exactly_when_did_you_think_america_was_great.html

Scott, S. C. (2017). Black Excellence: Fostering intellectual curiosity in minority honors students at a predominantly White research institution. *Journal of the National Collegiate Honors Council*, *18*(1), 109–133. http://digitalcommons.unl.edu/nchcjournal/547?utm_source=digitalcommons.unl.edu%2Fnchcjournal%2F547&utm_medium=PDF&utm_campaign=PDFCoverPages

Shafie, H., Majid, F. A., & Ismail, I. S. (2019). Technological pedagogical content knowledge (TPACK) in teaching 21st century skills in the 21st century classroom. *Asian Journal of University Education*, *15*(3), 24–33. https://doi.org/10.24191/ajue.v15i3.7818

Shapiro, E. (2019a, March 18). Only 7 Black students got into Stuyvesant, N.Y.'s most selective high school, out of 895 spots. *The New York Times*. https://www.nytimes.com/2019/03/18/nyregion/black-students-nyc-high-schools.html

Shapiro, E. (2019b, August 1). 'I love my skin!' Why Black parents are turning to Afrocentric schools. *The New York Times*. https://www.nytimes.com/2019/01/08/nyregion/afrocentric-schools-segregation-brooklyn.html

Shen-Berro, J. (2020, March 23). *"Unconscionable": Latino, black student numbers at NYC elite public high schools stay low*. NBC News. https://www.nbcnews.com/news/latino/unconscionable-latino-black-student-numbers-nyc-elite-public-high-schools-n1166741

Shih, M. J., Pittinsky, T. L., & Ho, G. C. (2012). Stereotype threat: Theory, process, and application. In M. Inzlicht and T. Schmader (Eds.) *Stereotype Threat: Theory, Process, and Application*. Oxford University Press. https://psycnet.apa.org/record/2011-27639-008

Simon, M. D. (2016). *Google sets sights on HBCUs for recruitment efforts.* NBC News. https://www.nbcnews.com/news/nbcblk/google-sets-sights-hbcus-recruitment-efforts-n601476

Simundich, J. (2017, December 6). *Why Brown University's $100 million plan to improve race relations falls short*. HuffPost. https://www.huffpost.com/entry/brown-u-plans-to-spend-10_b_8650776

Smeeding, T. (2016). Multiple barriers to economic opportunity for the "truly" disadvantaged and vulnerable.*: RSF: The Russell Sage Foundation Journal of the Social Sciences*, *2*(2), 98–122. https://doi.org/10.7758/RSF.2016.2.2.04

Sondern, A. (2019, February 2). *A design to bring life to death—The New York Times*. https://www.nytimes.com/2019/02/02/reader-center/overlooked-obituaries-news-design.html

Soremi, M., Samuels, S., & Cox, T. (2018). *Connecting the challenges faced by foreign-born students in higher education*. Adult Higher Education Alliance. https://files.eric.ed.gov/fulltext/ED590248.pdf

Sorkin, A. R. (2018, May 28). Why Starbucks's bias training, despite skepticism, is an important start. *The New York Times*. https://www.nytimes.com/2018/05/28/business/starbucks-stores-closed-racial-bias-sorkin.html

Staats, C. (2016). Understanding implicit bias. *American Educator (39*(4), 29–33. https://eric.ed.gov/?id=EJ1086492

Steele, C. (1999, October). *Secrets of The SAT* [Interview]. Frontline. Public Broadcasting system. https://www.pbs.org/wgbh/pages/frontline/shows/sats/interviews/steele.html

Strand, S. (2010). The White British-Black Caribbean achievement gap: Tests, tiers and teacher expectations. *British Educational Research Journal*, (38)1, 75-101. https://doi.org/10.1080/01411926.2010.526702

Strauss, V. (2013, September 12). Report: Race to the Top isn't delivering big results. *Washington Post*. https://www.washingtonpost.com/news/answer-sheet/wp/2013/09/12/report-race-to-the-top-isnt-delivering-big-results/

Strauss, V. (2020, June 18). *Perspective | The Trump administration is moving to restrict international students. Why that's a bad idea.* Washington Post. https://www.washingtonpost.com/education/2020/06/18/trump-administration-is-moving-restrict-international-students-why-thats-bad-idea/

Students of the Afrikana Community, Residents of Afrikan Heritage House and their Allies. (2013). *To the Oberlin Community* (Blog). Oberlin Microaggressions. https://obiemicroaggressions.tumblr.com/post/44694466981/to-the-oberlin-community

Sue, D. W., Lin, A. I., Torino, G. C., Capodilupo, C. M., & Rivera, D. P. (2009). Racial microaggressions and difficult dialogues on race in the classroom. *Cultural Diversity and Ethnic Minority Psychology*, *15*(2), 183–190. https://doi.org/10.1037/a0014191

Symonds, K. W. (2004). *After the test: Closing the achievement gaps with data.* Learning Point Associates.

Tarbutton, T. (2018). Leveraging 21st century learning & technology to create caring diverse classroom cultures. *Multicultural Education*, *25*(2), 4–6. https://eric.ed.gov/?id=EJ1181567

The U. S. Department of Justice Archives (2014, May 19). 60 years later: Fulfilling the promise of Brown v. Board of Education. https://www.justice.gov/archives/opa/blog/60-years-later-fulfilling-promise-brown-v-board-education

Thai, X. & Barrett, T. (2007, February 9). *Biden's description of Obama draws scrutiny*. CNN. https://www.cnn.com/2007/POLITICS/01/31/biden.obama/

Tisch, R. (2014). *Critical inquiry in developmental mathematics* [Doctoral dissertation]. University of Rhode Island. https://doi.org/10.28971/212014TR57

Torres, K. (2009). 'Culture shock': Black students account for their distinctiveness at an elite college. *Ethnic and Racial Studies*, *32*(5), 883–905. https://doi.org/10.1080/01419870701710914

Trawalter, S., Todd, A. R., Baird, A. A., & Richeson, J. A. (2008). Attending to threat: Race-based patterns of selective attention. *Journal of Experimental Social Psychology*, *44*(5), 1322–1327. https://doi.org/10.1016/j.jesp.2008.03.006

Tyner, A. R. (2019, August 26). Unconscious bias, implicit bias, and microaggressions: What Can we do about them? *GPSolo, 36*(4). American Bar Association. https://www.americanbar.org/groups/gpsolo/publications/gp_solo/2019/july-august/unconscious-bias-implicit-bias-microaggressions-what-can-we-do-about-them/

University of California, Berkeley, Library Guides (2019, September). *Women of hidden figures—Women who figure: An exhibit inspired by the mathematicians of hidden figures.* https://guides.lib.berkeley.edu/women-who-figure

University of Kansas (2015, September 16). *Choice of college major influences lifetime earnings more than simply getting a degree.* Science Daily. https://www.sciencedaily.com/releases/2015/09/150916112612.htm

U. S. Bureau of Labor Statistics. (2020). *Occupational employment statistics and wage statistics home page*. U. S. Bureau of Labor Statistics. https://www.bls.gov/oes/

U. S. Department of Education. (2010). *Race to the Top guidance and FAQ*. U. S. Department of Education. https://www2.ed.gov/programs/racetothetop/faq.pdf

U. S. Department of Education (2020). *Every Student Succeeds Act (ESSA* https://www.ed.gov/essa

U. S. Department of Justice (2015, June 8). *Case summaries*. https://www.justice.gov/crt/case-summaries.

U. S. Congress Joint Economic Committee (2012). *STEM Education: Preparing for the jobs of the future* (p. 17). https://www.jec.senate.gov/public/index.cfm/democrats/2012/4/stem-education-preparing-jobs-of-the-future

Van Overscheld, J. (2013). Project Lead the Way students more prepared for higher education. *American Journal of Engineering Education*, *4*(1), 1–12. http://dx.doi.org/10.19030/ajee.v4i1.7854

VanTassel-Baska, J., & Stambaugh, T. (Eds.) (2007, April 24-25). *Overlooked gems: A national perspective on low-income promising learners*. Proceedings from the National Leadership Conference on Low-Income Promising Learners, Washington D. C. National Association for Gifted Children & the Center for Gift Education, College of William and Mary. https://files.eric.ed.gov/fulltext/ED494579.pdf

Villegas, A., & Lucas, T. (2002). Preparing culturally responsive teachers: Rethinking the curriculum. *Journal of Teacher Education*, *53*(1), 20–32. https://doi.org/10.1177/0022487102053001003

Wallace, D. L., & Bell, A. (1999). Being Black at a predominantly White university. *College English*, *61*, 307–327. https://doi.org/10.2307/379071

Walters, N. P., & Trevelyan, E. N. (2011). *The newly arrived foreign-born population of the United States: 2010* [Brief]. American Community Survey Briefs. United States Census Bureau, U. S. Department of Commerce. https://www2.census.gov/library/publications/2011/acs/acsbr10-16.pdf

Walton, G. M., & Cohen, G. L. (2003). Stereotype lift. *Journal of Experimental Social Psychology*, *39*(5), 456–467. https://doi.org/10.1016/S0022-1031(03)00019-2

Waxman, O. B. (2020, February 6). *How Black Lives Matter is changing what students learn during Black history month*. Time. https://time.com/5771045/black-history-month-evolution/

Weedy, S. (2019, September 17). *Increasing access to gifted programs for low-income and Black & Latino children*. Child in the City. https://www.childinthecity.org

Weingarten, E. (2017, May 23). *Why pretending you don't see race or gender is an obstacle to equality*. IM Diversity. https://imdiversity.com/uncategorized/why-pretending-you-dont-see-race-or-gender-is-an-obstacle-to-equality/

Weiss, E. (2013, September 12). *Mismatches in race to the top limit educational improvement: Lack of time, resources, and tools to address opportunity gaps puts lofty state goals out of reach* [Report]. Economic Policy Institute. https://www.epi.org/publication/race-to-the-top-goals/

Weller, C. (2019, February 14). *African-Americans' wealth a fraction that of Whites due to systematic inequality*. Forbes. https://www.forbes.com

Weller, C. E. (2015, December 5). *African Americans face systematic obstacles to getting good jobs* [Report]. Center for American Progress. https://www.americanprogress.org

Wheeler, R. (2016). "So much research, so little change": Teaching standard English in African American classrooms. *Annual Review of Linguistics*, *2*(1), 367–390. https://doi.org/10.1146/annurev-linguistics-011415-040434

White House Historical Association (2020). *Benjamin Banneker*. White House Historical Association. https://www.Whitehousehistory.org/benjamin-banneker

National Academy of Engineering and National Research Council (2014). *STEM integration in K-12 education: Status, prospects, and an agenda for research*. The National Academies Press. https://doi.org/10.17226/18612

White, E. R. (2020, June 16). *Academic advising in a pandemic and beyond*. INSIDE HIGHER ED. https://www.insidehighered.com/advice/2020/06/16/importance-academic-advising-during-and-after-pandemic-opinion#.YS5tkFIqwi4.link

Williams, A. (2015, January 23). *Healthy parent-teacher relationships start with healthy student-teacher ones.* Education Week. https://www.edweek.org/leadership/opinion-healthy-parent-teacher-relationships-start-with-healthy-student-teacher-ones/2015/01

Williams, D., Martin, N., Consalvo, M., …& Ivory, J. D. (2009). The virtual census: Representations of gender, race and age in video games. *New Media & Society*, *11*(5), 815–834. https://doi.org/10.1177/1461444809105354

Wingfield, A. H. (2015, October 14). Being Black—But not too Black—In the Workplace. *The Atlantic*. https://www.theatlantic.com/business/archive/2015/10/being-black-work/409990/

Woo, E., & Curtius, M. (1996, December 20). *Oakland school district recognizes Black English*. Los Angeles Times. https://www.latimes.com/archives/la-xpm-1996-12-20-mn-11042-story.html

Wu, H., Garza, E., & Guzman, N. (2015). International student's challenge and adjustment to college. *Education Research International*, *2015*, e202753. https://doi.org/10.1155/2015/202753

Xue, Y., & Larson, R. C. (2015). STEM crisis or STEM surplus? Yes and yes. *Monthly Labor Review*, *U.S. Bureau of Labor Statistics*. https://doi.org/10.21916/mlr.2015.14

Yost, S. (2018, August 29). *Increasing equity for all students*. Edutopia. https://www.edutopia.org/article/increasing-equity-all-students

Young, J. L., Ero-Tolliver, I., Young, J. R., & Ford, D. Y. (2017). Maximizing opportunities to enroll in advanced high school science courses: Examining the scientific dispositions of Black girls. *Journal of Urban Learning, Teaching, and Research*, *13*, 174–183. https://eric.ed.gov/?id=EJ1149860

Yull, D., Wilson, M., Murray, C., & Parham, L. (2018). Reversing the dehumanization of families of color in schools: Community-based research in a race-conscious parent engagement program. *School Community Journal*, *28*(1), 319–349. https://files.eric.ed.gov/fulltext/EJ1184919.pdf

New York City Council (2019). *NYC City Council hearing on proposed specialized high school diversity measures* [Testimony of Liliana Zaragoza]. https://www.naacpldf.org/wp-content/uploads/2019-05-01_NYC-City-Council-Hearing-Testimony-on-Alternative-Plan-to-SHSAT-and-Proposed-Resolutions-re-Segregation-in-Specialized-Schools.pdf

APPENDICES

Appendix A: Survey

Students' perceptions of STEM pursuits.
Demographics

Please read each statement carefully. Answer what best describes you.

1. I am ____ years old. Mark only one oval.

15 16 17

2. I am in ____ grade. Mark only one oval.

11th 12th other

3. I identify as _____. Mark only one oval.

Male Female Nonbinary Other Prefer not to say

4. My ethnic background is _____. Mark only one oval.

African American/ Black LatinX/Hispanic Filipino Native White Mixed Other Korean

5. Would you be willing to answer follow-up questions regarding your perception of the school? I do, my email is _____@____ OR I do not. * please type your response

_____

Students' perceptions on school support and its impact on science pursuits.

You now have the opportunity to share your perception in current and past course(s). Please read every statement carefully and choose the one that best describes you. There are no right or wrong answers in this list of statements. It is simply a matter of what has been your experience. Additionally, your responses may be used by the researcher to support or refute a hypotheses regarding • Place an X or Click on the appropriate box to indicate your response. • These evaluations are confidential and independent.

1- Strongly disagree 2- Disagree 3- Agree 4- Mostly Agree 5- Strongly agree

Provide today's date

Example: January 7, 2019

Students' views: On school courses

The following statements are designed for you to express your level of relatedness to your school. Please read each statement carefully.

1. I am currently taking a science class. Mark only one oval.

Yes No

2. If so which one(s)? _____ Indicate the course(s) you are currently enrolled

_____

3. Why are you taking this course? Mark only one oval.

to meet graduation requirements
to prepare me for college requirements
because the course interests me
because there was nothing else available

4. I am currently taking a technology class. Mark only one oval.

Yes No

5. If so which one? If so which one? (Indicate which course(s) you are currently enrolled

_____

6. Why are you taking this course?

to meet graduation requirements
to prepare me for college requirements
because the course interests me
because there was nothing else available

7. I am currently taking an engineering class. Mark only one oval.

Yes No

8. If so which one(s)? _____ Indicate the course(s) you are currently enrolled

_____

9. Why are you taking this course?

to meet graduation requirements
to prepare me for college requirements
because the course interests me
because there was nothing else available

10. I am currently taking a mathematics class. Mark only one oval.

Yes No

11. If so which one(s)? _____ Indicate the course(s) you are currently enrolled

_____

12. Why are you taking this course?

to meet graduation requirements
to prepare me for college requirements
because the course interests me
because there was nothing else available

13. There are classes in the STEM field that I am interested in that I have not taken. Mark only one oval.

Completely disagree 1 2 3 4 5 Completely agree

14. If so which one(s)? _____ Share the possible courses that interests you

_____

15. What are the reasons you have not taken the classes listed above? _____
Please explain as best you can.

_____

_____

_____

16. I like science. Mark only one oval.
Completely disagree 1 2 3 4 5 Completely agree
17. Why or why not? a. I do because _____ **OR** b. I do not because _____
* Please indicate (a) or (b) & explain as best you can.
18. I like technology. Mark only one oval.
Completely disagree 1 2 3 4 5 Completely agree
19. Why or why not? a. I do because _____ **OR** b. I do not because _____
Please indicate (a) or (b) & explain as best you can.

_____

_____

_____

20. I like engineering. Mark only one oval.
Completely disagree 1 2 3 4 5 Completely agree
21. Why or why not? a. I do because _____ **OR** b. I do not because _____
* Please indicate (a) or (b) & explain as best you can.

_____

_____

22. I like math. Mark only one oval.
Completely disagree 1 2 3 4 5 Completely agree
23. Why or why not? a. I do because _____ **OR** b. I do not because _____
* Please indicate (a) or (b) & explain as best you can.

_____

_____

Students' views: Future Plans preparation
The following statements are designed for you to express your level of readiness after departing high school. Please read each statement carefully. Final section.
24. Have you applied for college? Mark only one oval.
Yes No
25. I plan to apply for college. Mark only one oval.
Completely disagree 1 2 3 4 5 Completely agree
26. If so, what do you plan to declare? _____ Indicate possible majors

_____

27. I am considering a career in science, technology, engineering, or math?
Completely disagree 1 2 3 4 5 Completely agree
28. Why or why not?_____ * Please explain as best you can.

_____

_____

29. I feel all students are equally represented in STEM classes. (Is there an equal representation of Asian, Black, Latinx, White students, etc.?)

Completely disagree 1 2 3 4 5 Completely agree
30. If you answered, ‘do not agree with this statement’, what do you think the reasons are? Please explain as best as you can.

_____

_____

31. From the number of science classes taken, how many were honors/AP courses ? (provide numbers) *_____ honors _____AP courses * Indicate the number of honors and AP courses participated (in the order presented). If none, indicate it as well. Mark only one oval.
0 1 2 3 4+
32. I participate in ___ science/engineering clubs. * ____Science ___Technology ____Architecture/Engineering ___Math * please provide the number of STEM clubs participated and the number of type of clubs (in the order presented).
Mark only one oval.
0 1 2 3 4+

Appendix B: Semi-Structured Interview Questions

1. How has science kept your attention and caused you to declare a science major? Or caused you not to declare as a science major?
2. What setbacks did you experience as you navigated through STEM courses? What strategies did you use as support to overcome these setbacks?
3. . Describe an experience that encouraged you and set you on the path to pursue a career in science.
4. If applicable, describe an experience that discourage you and set you on a different path other than science.
5. Why are Black students underrepresented in high school STEM classes? Why do you think that is?
6. What barriers you think inhibits Blacks from enrolling in STEM courses?
7. Why do Black students opt not to declare as a STEM major when applying to college? Why do you think that is?
8. Are you planning to declare as STEM major when you apply to college? Why?

Note: More questions will be added based on the survey data*

Appendix C: Parent Consent Letter

Date August 15, 2020

Dear Parent(s),

I will be conducting a study at the high school to determine your student's perception regarding student participation in STEM classes. The study will last five months. This is a part of a final research project for my doctoral degree at Concordia University Irvine, CA.

I am writing to ask permission for your student to participate in this study. Participation in this study involves completing a 20-minute questionnaire and possibly an interview of 20 to 30 minutes outside of school hours.

Concordia University Irvine has approved this study for implementation at Los Angeles Unified School District.

The significance of the study is to determine what changes can be made to include more students in high school STEM courses equitably, and therefore feeling prepared and confident to declare as STEM majors.

The benefits to your child for participating in this study include sharing their perspectives. Additionally, participation in an activity like this is a resume booster. A resume booster is an activity completed by a students that shows character and enhance their college and career resume.

Only the school counselor will have access to your child's identity and to information that can be associated to your child's identity. To minimize risk, their email addresses will be stripped and assigned a number identification. A list will be created by the counselor and a list compiled and given for those who choose to participate in a follow-up interview. Students' names and the school name will not be used in this research. The data and documentation will be destroyed by August 2023.

Use of data from your child is voluntary. Students will have the right to withdraw from the study at any time without penalty. If students feel discomfort at any time, they will be referred to the school psychologist, per school policy for social emotional distress. Confidentiality is priority.

You may contact me through my university supervisor, Dr. Belinda Karge at any time regarding your child's participation. The phone number is 949-214-3333 and e-mail is Belinda.karge@cui.edu.

Sincerely,
Concordia University Irvine
Doctoral student

Please check the appropriate box below and sign the form:

- ☐ I give permission for my child's data to be used in this study. I understand that I will receive a signed copy of this consent form. I have read this form and understand it.
- ☐ I do not give permission for my child's data to be included in this project.
- ☐ I give permission for my child to be interviewed if they choose to participate in that part of the research.
- ☐ I do not give permission for my child to be interviewed if they choose to participate in that part of the research.

Student's Name: _____

Parents/Guardian: _____ Date _____

NOTE this form with your name and your child's name needs to be returned to the school counselor. From there the student will be given a numerical code and the researcher and her advisory will only see that code.

Appendix D: Student Assent Letter

What is this study about?
A research study will be conducted to learn about students' views regarding student participation in STEM classes. The study will last ten months, however your participation will involve a 20-minute survey and if interested, follow up interview lasting approximately 20-30 minutes. This is part of a final research project for a doctoral degree at Concordia University Irvine, CA.
This study is to learn what factors lead to your choice to take or not take STEM classes. The study will also help expand the researcher's understanding about why students are interested in STEM and students are not. Your help is asked because you are in an age group where you will start to take steps regarding your future and your interests will help focus your goals and choices. Students will take part in study during non-instructional time. Therefore, it can take place during the following times of day: before school, during lunch and after school.

If you agree to be in the study, you will be asked some questions about types of classes offered on campus. The inquiry is if you think they are available to take and your experience while taking them if it applies. For example, you will be asked if you like science or not and are currently taking a STEM class.

You can ask questions about this study at any time. If you decide at any time you do not want to finish, you can just stop. If you feel anxiety or pressure, you can stop and ask permission to see the school psychologist. Please know your name and/or identity will be used in this study. The researcher will not name the high school you attend.

The questions asked are only about what you think. There are no right or wrong answers because this is not a test.

How many people will take part in this study?
About 100 students (15-17 years old that are 11^{th} and 12^{th} grade students) in this school site will be in this study. About 7-10 will participate in interviews.

If you sign this paper, it means that you have read this letter and that you agree to participate in the study. If you don't want to be in the study, don't sign this paper. Being in the study is up to you, and no one will be upset if you don't sign this paper or if you change your mind later.
Student full name: _____
Date of Assent: _____

Appendix E: VIDEO/AUDIO USE

As part of this research project, the researcher (doctoral student at Concordia University Irvine) will be making an audio recording of your responses during your participation in the interview. The video and audio recording will only be used to ensure the transcription reflects your responses accurately. Please indicate your assent to use the audio recording for this purpose. If you do not want your responses recorded, the researcher will transcribe your responses only. **Please indicate your informed consent.**

The audio/video recording can be studied by the researcher for use in the research project. Please initial ____

I have read the above description and give my consent for the use of the audio recording as indicated above.
Signature: _____ Date: _____
Printed Name: _____

Appendix F: Flyer Invitation/Post Invitation

Post #1

Have you come across opportunities that will create a competitive edge?
Participate in research looking at representation in STEM. In return, you receive a resume booster.
Follow the 3 steps below:
1. Parent Consent: https://forms...link will be inserted
2. Students Assent Letter: https://forms...link will be inserted
3. Student Perception on STEM Pursuits: https://forms. ...link will be inserted

Post #2

Starbucks gift card drawing for every 25 participants!
Want a competitive edge as you pursue your dreams.
Participate in research looking at representation in STEM. In return, you receive a resume booster. Follow the 3 steps below:

1- Parent Form -https://forms...link will be inserted
2- Student Assent -https://forms...link will be inserted

Once above forms submitted

3- Survey -https://forms...link will be inserted

Appendix G: Certificate of Completion

Certificate of Completion

The National Institutes of Health (NIH) Office of Extramural Research certifies that **Freda Antoine** successfully completed the NIH Web-based training course "Protecting Human Research Participants."

Date of Completion: 09/12/2018

Certification Number: 2925359

NIH National Institutes of Health
Office of Extramural Research

Appendix H: CITI Program

CITI PROGRAM

Completion Date 01-Mar-2019
Expiration Date 28-Feb-2022
Record ID 30678964

This is to certify that:

Belinda Karge

Has completed the following CITI Program course:

Social & Behavioral Research - Basic/Refresher (Curriculum Group)
Social & Behavioral Research (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

Concordia University Irvine

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?wb1bf6138-fc2f-4774-ba1a-5ef227d51782-30678964

Appendix I: Site Authorization

Appendix J

CONCORDIA UNIVERSITY IRVINE

APPENDIX J: SITE AUTHORIZATION

Title of Study	SEEKING EQUITY IN STEM: BLACK HIGH SCHOOL STUDENTS
Researcher/s	Freda Antoine
Researcher/s' Affiliation with Site	Student
Researcher/s' Phone Numbers	646-765-6723
Researcher/s' CUI Email (unless not from CUI)	freda.antoine@eagles.cui.edu
Researcher/s' University Supervisor	Belinda Karge
Univ. Supervisor's Phone & Email	belinda.karge@cui.edu
Location/s where Study will Occur	Fairfax Senior High School/Online

Purpose of Study (1-2 paragraphs)

The researcher's main intention is to discover why so few Black students enter pathways that lead to careers in STEM. This dissertation explores this issue from the perspective of Black high school students. It aims to find out what their experiences are in STEM classes. Why they think they are under-represented in STEM classes and why they opt not to declare STEM majors when applying to college? This research will be added as a contribution to support student access. It explores why the lack of Black participation in STEM. Sharing the findings as perceived by upperclassmen secondary students can inform the next steps to supporting initiatives aimed to increase involvement. This study will inspire schools to take steps to eliminate the equity gap contributing to Black students being under-represented in STEM courses.

Procedures to be Followed

The quantitative tool used in this study are surveys. Obtaining consent from parents to gather student data is needed first. Upon agreement to be a participant, student assent forms are registered. Surveys are administered, after forms are collected, via online then submitted to the Google forms platform. A surveyor oversees the survey, removing identifiable information like student's email address to maintain confidentiality.

The qualitative methods consist of a list of the open-ended interview questions given to each participant. Each participant will be asked if they have any questions or if clarification is needed before the interview is conducted. Participants will be asked to elaborate or clarify information previously stated on surveys. A reliable and quality recording device used to increase dependability, capture fine details and answers. Qualitative methods will used to analyze and gain understanding into student's perspective.

Time and Duration of Study

July 2020 - December 2020

Benefits of Study

The findings will yield vital information to inform what inequities exist regarding STEM access and participation and share with sample school. Upon completion, the final report will be given to LAUSD's Committee of External Research Review (CERR). Then added to professional development for staff regarding student equitable access and participation.

Persons who will have access to the records, data, tapes, or other documentation (see Application Process Step C. 3 of Handbook)

The researcher will have access to the records, data, tapes, or other documentation

Date when the records, data, tapes, or other documentation will be destroyed: December 2023

Researcher's Signature _____ Date August 20, 2020

---------- **Authorization** ----------

Appendix J: LAUSD Approval

Los Angeles Unified School District

Office of Data and Accountability

333 South Beaudry Avenue, 16th Floor, Los Angeles, California 90017

Telephone: (213) 241-2460 Fax: (213) 241-8462

Austin Beutner
Superintendent of Schools

Veronica Arreguin
Chief Strategy Officer

Oscar Lafarga
Executive Director

May 19, 2020

Ms. Frida Antoine
10855 Whipple Street # 204
North Hollywood, CA 91602

Proposal # 773

Dear Researcher:

The LAUSD Committee for External Research Review has approved your request to initiate the research study entitled "Does the US STEM Education Pipeline include Black Students?" This action by the Committee is an approval to conduct your study in LAUSD schools according to the terms presented in the Statement of Agreement for External Researchers and signed on May 19, 2020. This letter does not:

- Create any obligation for district personnel, students, or parents to participate. All participation must be completely voluntary, and the confidentiality of all sources must be maintained.

- Permit the administrators or staff to engage in this study during paid work time nor any students to engage in this study during instructional time.

In our effort to document burden on schools, please let our office know the names of the schools where you will be collecting the data. We understand that you may not have selected your final sample schools nor have gotten permission to collect data, however, we will need to know as soon as you know. The approval is valid for one year from the date of this letter.

At the conclusion of your study or one year from today, whichever comes first, please send a practitioner-friendly summary (Power Point presentation, infographic, research brief, etc.) of your findings and copies of any reports to my attention. I wish you the best of luck in your research endeavors.

Sincerely,

Katherine Hayes, Ph.D.
Coordinator CERR, School Experience Survey
Research and Reporting Branch
Office of Data and Accountability
Los Angeles Unified School District
333 S. Beaudry Ave. 16th Floor
Los Angeles, CA 90039