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An Examination of Black Male Success in High School Mathematics

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An Examination of Black Male Success in High School Mathematics

by

David Walters Jr.

A dissertation submitted to the Graduate Faculty in Urban Education in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York

2016
Approval Page

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This manuscript has been read and accepted for the Graduate Faculty in Urban Education in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

March 29, 2016

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Abstract

An Examination of Black Male Success in High School Mathematics

by

David Walters Jr.

Advisor: Juan Battle

For a national sample of Black male students, what is the relative impact of instructional technology on 10th and 12th grade math scores? This dissertation employs two waves of the Education Longitudinal Study (2002 & 2004) and multivariate statistical techniques to explore the relative importance of instructional technology (implementation by teachers and training for teachers), student perception of math ability, teacher and school effects, as well as socioeconomic status on high school math scores for this unique population.

Bourdieu’s cultural and social capital, Coleman’s cultural capital and social action, Martin’s equity-based math education, and Gutierrez’s socio-political mathematics will serve as theoretical lenses for this work.
Acknowledgements

I would like to give thanks to God for the abundance of favor, blessings and love gifted to me. To my parents, Valerie and David, your love and support is everything to me. My brother, John, you are my best friend; I am grateful to you for your patience, kindness and honesty. I feel truly blessed to have been taught and mentored by Dr. Juan Battle, Dr. Anthony Picciano and Dr. Dante Tawfeeq; your scholarship, time and wisdom were invaluable to the success of this dissertation and personal/professional growth. To all of those beautiful people who have not been mentioned, you are all loved and appreciated. Thank you for everything!
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Chapter 1: Introduction

This chapter familiarizes the reader with the critical nature of Black male math achievement and highlights theoretical lenses and relevant literature to support this dissertation. The methodological tools used to test relationships and strategies for answering salient questions are presented as well.

1.1 Introduction

This dissertation explores and explains how instructional technology affects Black male secondary school students’ math academic achievement. This quantitative study employs the Education Longitudinal Survey of 2002 (ELS: 2002), a nationally representative survey of over 15,000 students, to examine instructional technology student use and teacher technology training. Additionally, student perception of math ability, teacher/school effects and socioeconomic status were chosen through careful review of relevant literature as factors which may contribute to student outcomes. This study provides an opportunity to add to the deficit-filled Discourse of Black male achievement with education technology.

The highly competitive nature of the global market has led to an increased use of information and communication technology (ICT) -based learning for students around the world. This global education agenda has been met with significant government investments in education technology (Pedro, 2012). With advances in instructional technology and greater use in teaching and learning, its effect on academic performance remains poorly understood. Most education policy and research over-emphasize access
to technology; policies and studies must address these resources in the context of process (Pedro, 2012). Education research studies show that the use of technology in instruction can help student learning (Becker, 2000), yet student outcomes are a reflection of how teachers use those resources (Thomas & Palmer, 2014). There is a need for research that will explore how teacher technology use influences student achievement. Proper use of technology in education requires administrators and educators to develop curricula and teacher training that accounts for how students make meaning with these resources (Harvey & Purnell, 1995; Jonasson, 1993).

The education of Black males in the United States is in a state of crisis. Black males are among the United States’ lowest performing demographics. Previous education, psychology, sociology and anthropology research of this marginalized group has found few solutions to the issues concerning their academic outcomes. According to Berry (2015), research agendas that represent the dominant Discourse of Black education fixate on group comparisons to White learners. Research centered in the achievement gap between Blacks and Whites serves only to document the problem. Now that majority of American students are under the auspices of the Common Core Standards, which outline the proper use of technology in math as a mark of proficiency, research must consider how Blacks males learn with technology. How will this unique population raise academic achievement with the implementation of the Common Core Standards Initiative? This dissertation takes the first step in identifying how student outcomes are affected by technology. These findings will support future research that seeks to effectuate positive growth in the achievement of this marginalized group. Through an understanding of how these students learn mathematics with technology, coupled with
additional student/teacher/school-level factors, these findings can then move to examine the factors that contribute to success.

1.1.1 Statement of The Problem

Despite literature on the disparities in scholastic achievement between Black and White males, there is a need for research on how to prepare Black males for the multi-faceted standardized mathematical components of the Common Core Standards Initiative, which describes proficiency in mathematics as competence in the use of high-level technology. What aspects of teaching with technology for the secondary school mathematics classroom are conduits for and barriers to academic success for 10th and 12th grade Black males?

This study will contribute to the Discourse on technology and Black male academic achievement. A quantitative research design will be used to understand how technology use and teacher technology training affect student success in mathematics. Additionally, teacher and school effects, student self-perception, and socioeconomic status will be analyzed with respect to mathematics achievement.

1.1.2 Rationale

In response to low-rankings in the Trends in International Mathematics and Science Study (TIMMS) and Program for International Student Assessment (PISA), the United States developed the Common Core Initiative, in 2009. Sponsored by the National Governors Association and the Council of Chief State School Officers, it set consistent standards for teaching and learning across K-12 grade levels in English language arts and mathematics. According to the Common Core State Standards
Initiative, as of 2014, “Forty-three states, the District of Columbia, four territories, and the Department of Defense Education Activity have adopted the Common Core State Standards” (CCSSI, 2014). The fifth Common Core standard for mathematical practices states that:

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include such things as pencil and paper, concrete models, ruler, protractor, calculator, spreadsheet, computer algebra system, statistical package, or dynamic geometry software. Proficient students are familiar enough with tools appropriate for their grade or course to make sound decisions about when each might be helpful, realizing the limitations of the tools and the output that they generate. (CCSSI, 2014)

The Common Core Standards state that mathematically proficient students understand the proper use of technology for inquiry-based learning. With this in mind, research on Black male student achievement must examine the effectiveness of using high-level technology in the classroom.

In June of 2013, President Barack H. Obama announced the ConnectED initiative to provide high-speed broadband Internet to 99% of students within five years. According to Horrigan (2014), there is a digital divide in the United States with regard to Internet broadband speeds for Blacks, Latinos/as, low-income, and rural students. In the winter of 2014, Obama’s My Brother’s Keeper initiative to eliminate inequities in education faced by young men of color was a signal of national executive concern. Now,
more than ever, there is a need for research that will even the playing field for Black male youth and ensure that greater opportunities for success in education.

1.1.3 Contribution to the Field

While the Discourse on Black male achievement has focused on the achievement gap, there is little research that examines how instructional technology impacts the achievement of this marginalized group. Proper use of instructional technology has been proven to improve student learning when teacher and student attitudes are positive. This dissertation employs a nationally representative sample of Black male students to understand how they learn math using technology and having teachers well trained in it’s use. Findings of this study will identify the predictors for Black male success through forms of technology use that align with the Common Core Standards.

1.2 Background

This dissertation is a quantitative study of Black male math achievement concerning the use of instructional technology and the technology training of their teachers. Through the use of the ELS: 2002 public-use dataset and SPSS 22 statistical software, this study will analyze the relationship between outcomes and: instructional technology, student self-perception of math ability, teacher/school effects and socioeconomic status. The interpretation of findings will be examined through the lens of Bourdieu’s cultural and social capital, Coleman’s cultural capital and social action, Martin’s equity-based math education, Gutierrez’s socio-political mathematics and other relevant literature.
1.2.1 Theoretical Framework

Bourdieu (1985) identifies social capital as the possession of resources that promote the status quo and provide agency to the dominant social group. Cultural capital encompasses the attributes, codes, signals and ways of being that align with the dominant cultural group (Carter, 2003). Social capital allows for access to target fields, while cultural capital represents the tools necessary to exist in those fields. Economic capital is the possession of financial resources, which allow access to social networks. Despite the research that shows that economic capital is the greatest predictor of academic success (Sirin, 2005), this dissertation also looks to other factors that are significant to outcomes.

This dissertation examines the math outcomes of Black male secondary school students when supported by instructional technology. Schools are designed to prepare our nation’s human capital to enter employment with social and cultural skills to gain societal agency. In order for Black Americans to be successful in American schools they must possess the social and cultural capital necessary to access to dominant culture’s social networks (DiMaggio, 1982). DiMaggio (1982) states that possession of social and cultural norms are the best way for those with lower socioeconomic status to gain agency. These norms are usually passed down to children by their family in groups with higher SES, securing path to information, education, health care and employment. Black Americans are classified by Ogbu (1998) as involuntary minorities. Involuntary minorities represent those Americans and their descendants “who have been conquered, colonized, or enslaved” (Ogbu, 1998, p.165), while voluntary minorities are Americans and their descendants that came looking for opportunity for a better life. Voluntary minorities that have achieved success have done so using these dominant forms of capital
to gain opportunities for success. Involuntary minorities have been subjugated by the dominant White culture for centuries and have created their own ways of being, some of which stand in opposition to it. Linguistic capital involves mastery of language as an important resource. Voluntary and involuntary minorities have found greater success with mastery of the lingua franca American English. Many Black children use a dialect of American English that is not acceptable in schools. Their development of separate ways of being in response to their exclusion has also barred them from agency to the existing dominant sociocultural framework. Confining people to communities and denying access allowed for the creation of this non-dominant ontology.

In a sociological study of the urban Black community, Wacquant (2012) found that many of the agents in this field use non-dominant forms of social and cultural capital. As a historically oppressed group, due to shared racialized experiences, these inhabitants find comfort with each other. The community has a shared identity, which is set against social and cultural norms. The confinement of these marginalized groups in separate neighborhoods from their White counterparts, creates a disconnect with regard to forms of knowledge. The White canonical education system is rooted in social and cultural norms, which in turn pronounce the Black forms of knowledge deficient. While the social benefits of maintaining an identity of a non-dominant culture provide agency within some Black communities, these worldviews may disallow agency in school.

In an examination of the social actions of this marginalized population Coleman (1966) found that schools did not possess adequate resources from facilities to teachers to properly educate their children. Coleman (1988) found that this social structure affects the ability for this group to perform in social contexts.
Bourdieu and Coleman provide the macro-level theory for the interpretation of this dissertation’s findings. Their works contribute greatly to the understanding of educational disadvantages faced by this unique group of students.

An examination of the Discourse on Black male students illustrates an over-documentation of group comparisons with White students. This approach has produced only a stigma of deficiency for Black males, while elevating their White counterparts as the norm for success. Martin (2012) and Gutierrez and Dixon-Roman (2011) propose a paradigm shift away from the achievement gap to culturally responsive mathematics education. Culturally responsive mathematics involves the production and development of positive fields of inquiry that welcome all forms of knowledge and successively link them to standards-based content knowledge. Teachers must be trained to bridge cultural and social norms to bring agency to all by facilitating social interactions. Through an understanding of how Black students learn and value their forms of knowledge, students can be steered to the positive attributes they possess that lead to scholastic prowess. According to Martin (2009), research must look to the experiences of Black students as racialized experiences; paying close attention to the success and resilience of these children. Gutierrez (2008) states that to find how Black students learn they need to be compared to themselves. In addition, the development of curricula should bear in mind the need for social justice in education.

1.2.2 Literature Review

According to Pedro (2012), global education has moved to the use of education technology to support the growth of human capital for the global economy. The Common Core reform boasts over 85% of American students that fall under their national
standards for math and reading across all grade levels. According to the CCSSI (2014), the standards are designed to prepare our nation’s students for college and careers. To assess student achievement levels and rate teacher effectiveness, this initiative administers annual standardized exams on each grade level. The Common Core Standards Initiative mandated the use of instructional technology for all math secondary school classes. Set as a mark of proficiency, technology now presents new challenges for schools and their agents. According to Thomas and Palmer (2014), technology classrooms need teachers that are able to facilitate math instruction through the use of technological resources. There is a need for teachers that can use pedagogy, content knowledge and technology in concert to better educate students. In a technology study of secondary math teachers, Thomas and Palmer (2014) concluded that teachers were unable to create technology-based learning environments. There is a need for professional development for in-service teachers and pre-service training in technology to improve the implementation of these resources into the curriculum.

The Common Core assessments are criterion-referenced tests that measure performance with standards-based concepts. The data gathered from these tests serve as evidence for the federal government to compare the achievement of groups of students and create education policy (Hanushek & Rivkin, 2010). These exams are the benchmark for success and a predictor of success in higher education and access to higher paying jobs.

As mentioned earlier, this study will identify the predictors for Black male success when teachers have undergone technology training and use technology in the
classroom. In addition, to the technology elements there are other factors that contribute to student outcomes.

In a qualitative study, identifying the role of perceptions in academic engagement and performance, Wood (2014) interviewed Black male students finding introversion, anxiety and lack of focus as contributing factors to their performance. Stereotype threat was a main hindrance to engagement; students felt that their classmates would see them as unintelligent if they were incorrect. This academic disengagement fostered a lack of identification with fellow students and teachers. Comfortable learning spaces with teachers that facilitate the understanding of different points of view allow all forms of knowledge to be considered and respected. Ryan & Shim (2012) found that help-seeking by students provided greater success in learning and completing tasks. These students are shown to have greater self-perception of math ability and higher outcomes than those who do not. In a quantitative study of the relationship between perception and math achievement, Schenke et al. (2015) concluded that students that perceived higher levels of support from their classroom agents showed greater gains in math outcomes. In a quantitative study of the relationship between mental rotation ability and self-perceptions of high school geometry students (Weckbacher & Okomoto, 2014), found that perception of math ability and student task success were positively aligned and statistically significant. Research shows that student perception of math ability is a powerful predictor of student success.

Teaching with technology requires that teachers gain the skills necessary to provide instruction for all students. Historically, students of marginalized groups have the least experienced teachers, ill-equipped facilities, lower level resources and low
student achievement (Coleman, 1966; Coleman, 1988; McGee, 2009). These inequities on the teacher and school level prompted this dissertation to consider the teacher and school effects that may impact student math learning.

The National Center for Education Statistics (NCES) (2014) indicated that 83% of public school teachers are White. According to the NCES (2011), Black schools have three times the number of non-major and uncertified math teachers as White schools. Disadvantaged low-income students have the greatest need for effective teachers (Monk, 2007; Jacob, 2007). Highly-qualified math teachers are not attracted to these high-need schools (Ingersoll & Perda, 2009). Research evidences that low-income schools have teachers with the lowest qualifications, less teaching experience and lower content certification scores (Clotfelter et al., 2007). The inability of these schools to recruit and retain highly-effective teachers impacts the level of quality instruction provided to these students. Ingersoll & Perda, (2009) state that math and science teachers have the highest attrition rates in these schools. How can students battling these kinds of inequities achieve academic success?

According to Horrigan (2014), students in predominately Black/Latino/a urban schools have broadband speeds far lower than suburban students. The impact of urbanicity will be explored in this dissertation to account for this inequity. This allows for an understanding of how this digital divide impacts learning with instructional technology.

McGee (2009) discusses the lack of male education professionals in Black schools; theorizing the value of male role models for this marginalized population. This
dissertation will explore this issue of race/gender/ethnicity matching of teachers with their students.

Prior research shows that socioeconomic status is the greatest predictor of academic prowess. In the Coleman Report, Coleman (1966) states that student background and socioeconomic status are the greatest predictors of academic outcomes. Sirin (2005) posits that there exists a strong positive correlation between student outcomes and SES. It is the most important factor with regard to educational and career opportunities. DiMaggio (1987) states that students with higher SES perform better than those of a low SES background.

1.3 Methodology

As previously mentioned, this quantitative study uses the Education Longitudinal Survey of 2002 dataset for public-use to analyze and interpret how education technology and other factors impact Black male student outcomes. To analyze the dataset, this dissertation utilizes the SPSS 22 statistical software to perform bivariate and multivariate analyses. The findings of T-tests, ANOVA, Pearson’s r and OLS regression will be interpreted using the theoretical framework and scholarly literature in the following chapter. The limitations, implications and considerations for future research will follow to contribute to the Discourse on Black male achievement and offer suggestions for policy implications.

1.3.1 Procedure

The Educational Longitudinal Study of 2002 (ELS: 2002), a nationally representative dataset that monitors the progress of American high school students
through their secondary and post-secondary endeavors. The first two waves of this survey, the base year and first follow-up year will be used for this study. This public-use dataset will be downloaded in .sps format and manipulated through SPSS 22. Through the use of relevant literature, salient variables will be chosen and carefully manipulated based on type (nominal, ordinal, interval ratio). Factor analysis will be used when needed as a structural mechanism and data reduction tool, so that larger unobserved variables would be explained with smaller unobserved variables. Independent variables will be grouped in the following domains:

1. Instructional Technology
2. Teacher Technology
3. Perception of Math Ability
4. Teacher/School Effects
5. Socioeconomic Status

Dependent variables are 10th and 12th grader standardized tests scores. Using SPSS, the data will be aggregated to filter out Black male students that: use technology in the 10th grade math classroom, use technology in the 12th grade math classroom, have math teachers that have been trained in technology in the 10th grade and have math teachers that have been trained in technology in the 12th grade. These four aggregates represent the focal domains for each of the four regressions used for this dissertation. In addition to these independent focal domain variables, perception of math ability, teacher/school effects and socioeconomic status constitute the remaining domain variables for each of the four regression analyses.

The ELS: 2002 uses a multiple respondent population design. It presents data from secondary students, parents and school staff respondent questions offering
opportunities to analyze and interpret nationally representative data on students, teachers and their institutions of learning.

1.4 Dissertation Outline

Chapter II will examine relevant scholarly works that contribute to technology use in education, Black male academic outcomes, perceptions of mathematical ability, teacher technology training, teachers of Black male youth, and SES. In addition, the logics of the macro- and meso-level theoretical framework will be discussed in greater detail as they relate to this dissertation.

Chapter III will explore and explain the methodology used to retrieve, analyze and interpret data from the ELS: 2002 public-use data set through the use of SPSS 22 statistical software.

Chapter IV will report and explain the findings of the statistical analysis of a battery of variables from the ELS:2002 survey dataset via SPSS 22 uni/bi/multivariate analysis and multivariate modeling. It will discuss how ICT in education affects Black male outcomes in mathematics with respect to statistical significance.

Chapter V will present the results of the dissertation. All data will be thoroughly analyzed and interpreted through the use of relevant literature, most of which will have been previously mentioned in the literature review. It will also provide a theoretical discussion designed to interpret findings through the lens of this study’s macro- and micro-level theories.

Chapter VI will provide a clear explanation of the impact of instructional technology variables and other supporting factors on Black male student achievement to
make generalizations regarding student outcomes. From these generalizations, implications, recommendations for policymakers/education professionals, and suggestions for future research will be made so that interventions to increase Black male success in mathematics.
Chapter 2: Theoretical Framework & Literature Review

This chapter introduces critically evaluated logics, which represent the macro- and meso-level of my dissertation. The literature review identifies and examines scholarly works in Black male academic achievement, technology education, student perceptions of mathematical ability, teacher technology training, teachers and schools of Black male youth, and socioeconomic status, as they relate to this dissertation.

2.1 Introduction

The purpose of this study is to explain the impact of instructional technology on 10th and 12th grade math scores for Black males. More specifically, how do instructional technology (implementation by teachers and training for teachers), student perception of math ability, teacher and school effects, and socioeconomic status encourage or constrain high school standardized math scores for this population? This dissertation uses a theoretical framework rooted in Bourdieu’s economic, cultural and social capital, Coleman’s cultural capital and social action, Martin’s equity-based math education, and Gutierrez’s socio-political mathematics.

Bourdieu and Coleman represent this dissertation’s macro-level theories. From their work, the phenomena of agency in social/cultural fields and social action explore and explain the social and cultural factors that become conduits or barriers to academic achievement for this dissertation’s marginalized sample.

As a historically oppressed group, Black learners ontology is rooted in race. Race, as a social construct, allows research to consider all experiences of Black students as racialized forms of experience (Martin, 2009). Martin and Gutierrez represent this dissertation’s meso-level theories. Martin (2009) states that to understand how Black
students learn it is important to understand how they see their communities, schools and ways of being. Through these experiences research can identify factors, which contribute to success and failure; this information shapes responsive pedagogical practices that can be used to connect students’ forms of knowledge with the dominant forms that are required for academic success. Gutierrez sociopolitical mathematics examines the teaching and learning of mathematics against the backdrop of social justice and politics. According to Gutierrez & Dixon-Roman (2011), researchers spend too much time exploring the achievement gap between marginalized students and their White counterparts. Education research and the development of pedagogical practices should consider what marginalized students are doing well and use responsive pedagogical approaches to improve student success.

In addition to the theoretical framework, this chapter explores relevant literature with respect to Black male student achievement, standardized assessments, instructional technology, teacher technology training, student perception of math ability and socioeconomic status. Based on the theoretical framework and the literature herein, the domains for study were identified and variables were chosen for this quantitative dissertation.

2.2 Theoretical Framework

Bourdieu’s theory of cultural capital, derived from Marx’s social theory of class (Bourdieu & Wacquant, 1992), will provide the theoretical framework for this paper. Marx’s work on class theory posits that the ruling class controls the means of production and creates a social interplay where people conform to a hierarchical social structure (Marx & Engels, 1943). Marx believed this set of social relations benefitted
groups with access to capital (the means of production and other economic assets) but proved detrimental to those without it. Within this structure, people sharing similar relationships to the means of production form worldviews, which Marx referred to as ideology (Hernadi, 1989). In their everyday life subaltern groups, in particular the working class, are likely to internalize a dominant ideology, which develops from ideas that serve the interests of the ruling class (Kolakowski, 1978). Yet this dominant ideology when refracted through different class experiences reveals class distinctions. Marx’s social theory of class laid the foundation for Bourdieu’s theories of social and cultural capital. Bourdieu looked to the nuances and contradictions held by these social constructs to develop a more complete analysis.

Bourdieu came to develop the idea of cultural capital when researching disparities in educational outcomes among students in France. His investigation of the unequal scholastic achievement of youth led him to theorize that there were forms of knowledge, skill sets, and social advantages that improved the status of an individual.

Bourdieu expands on Marx’s analysis by considering other forms of capital than those related to ownership of the means of production, primarily economic capital. Bourdieu considers the role of social capital in the reproduction of society. He defines it as “the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition” (Bourdieu, 1985, p. 248). Through participation in social networks, which play a role in maintaining the status quo, an agent gains access to resources, which allow potential for growth. The more social capital one possesses the more access to progressively different/higher-level social groups. A second form of capital that
Bourdieu sees as foundational to the social structure is cultural capital, which is basically knowledge of the rules and mores of society. He describes “dominant cultural capital” as a society’s “powerful, high status cultural attributes, codes and signals (quoted in Carter, 2003, p. 138).” Social capital provides access to social networks, and cultural capital allows individuals to operate within those networks.” As mentioned in the Introduction, economic capital is the possession of financial resources that provide opportunities for success. This form of capital was only used to support the strength of socioeconomic status in this dissertation; bringing focus to the individual, familial and school-level factors that effectuate positive growth in math tests scores for Black males.

Coleman (1988) uses the concept of social capital to examine the interplay among agents in a society. He defines three forms of social capital: obligations and expectations, information channels, and social norms. The social action of agents, whether rational or purposive, coupled with social contexts provide insight into individual actions and group dynamics. The social structure affects how actors relate to one another and how productive certain actions may be in certain fields. Educational elements that aid in the efficacy of social capital include: effective teaching, use of technology to support teaching and learning, college preparation, college counseling, positive student-teacher/staff relations and additional educational opportunities. They are the currency rewarded to those who acquire and use their dominant cultural capital.

The failure of Black males in public education can be attributed to many social issues. Therefore, research into the teaching and learning of Black male students must examine their education from a historical, cultural, social, and political context. The social relations and actions of Black males stem from their home and community life and
are then projected into various fields. The Black community consists of “distinct and parallel institutions to compensate for and shield themselves from an unflinching exclusion by Whites…” (Wacquant, 2012, p. 39).

Bourdieu’s forms of capital and Coleman’s social action and capital theories provide a macro-level framework to explore and explain the effects teacher technology use have on Black male performance in math. While the Common Core identifies the use of technology in the math classroom as a mark of proficiency, Bourdieu and Coleman offer theories that show how Black males and other marginalized groups suffer disadvantage with respect to teaching and learning. Disparities in education, which, due to a lack of dominant forms of capital, affect Black males and their life chances, motivate this dissertation’s focus on mathematics education.

Can American schools offer a math education that incorporates home and community culture? Martin (2012) proposes an equity-based theory of teaching Black children mathematics and calls for a paradigm shift away from a race-comparative approach, which emphasizes the achievement gap between Black and White students. Gutierrez and Dixon-Román (2011, p. 21) term this phenomenon a “gap-gazing fetish.” This type of normalization measures Black children on a scale designed to account for the mathematics competency of White children in a White canonical mathematics education curriculum. The achievement gap dwells on the failures of Black youth and has “the deleterious effect of helping to position Black children at the bottom of a racial hierarchy of mathematics ability” (Martin, 2012, p. 48). There is little, however, to account for the positive attributes that Black children can contribute to scholastic achievement. Martin (2009) contends that not enough attention is paid to the success and resilience of Black
children. Therefore, research in the achievement of marginalized youth should examine how these students learn and offer evidence to policymakers for the development of culturally responsive mathematics education.

Gutierrez has developed socio-political mathematics theory, an equity-based theory, to examine the interplay of society, politics, and education. The theory takes into account the role of power and identity in educating youth and the need for social justice in education. Gutierrez states that research “examining the gap from its many angles and perspectives has done little to change the will or commitment of a nation to engage its citizens in broader forms of mathematical literacy” (Gutierrez & Dixon-Román, 2011, p. 22). Accordingly, gap-gazing promotes assimilation and researchers tend to explore how marginalized groups can mimic dominant groups. Gap-gazing ignores social frameworks but provides racialized identities to underrepresented peoples. It does not allow these groups to be studied on their own terms but only in comparison to others (Gutierrez, 2008).

“Gap-gazing relies upon narrow definitions of learning and equity assuming that today’s school mathematics curriculum is the one to which we should aspire and that access to an unfair system is a sufficient goal” (Gutierrez & Dixon-Román, 2011, p. 23). Gutierrez urges educators and education policymakers to consider a comprehensive approach to mathematics education: to see it in its philosophical, historical, political, cultural and social aspects, to recognize the development and importance of mathematics inside the classroom and out.

It is within this theoretical framework that this study will investigate success in mathematics for 10th and 12th grade Black males across the use of technology to support
teaching and learning, teacher technology training, student perceptions of mathematical ability and socioeconomic status.
Figure 2.1 Theoretical Framework

- Bourdieu: Social & Cultural Capital
- Coleman: Cultural Capital
- Martin: Equity-Based Math Education Theory
- Gutierrez: Socio-political Mathematics
- This Dissertation
2.3 Literature Review

This section highlights relevant scholarly works with regard to: instructional technology, teacher technology training, standardized testing and Black male academic outcomes, perceptions of mathematical ability, teachers of Black male youth and SES. In addition, factors which support those prefaced earlier are discussed in detail.

Instructional Technology

According to Picciano (2014), the increased use of instructional technology has caused educational institutions to examine how they provide instruction. Educational technology includes information and communication technology (ICT) in education, e-learning, digital education, EdTech, multimedia learning, instructional technology, m-learning, computer-aided instruction, computer-managed instruction, flexible learning, blended learning, web-based training, online education, virtual education and personal learning environments (Moore et al., 2011). As new iterations of instructional technology continue to be developed, administrative school agents have to make decisions regarding which technological tools will best contribute to the teaching and learning of mathematics. This dissertation will contribute to the literature on the impact of instructional technology on Black male student achievement in math as described in the Educational Longitudinal Study of 2002 (ELS: 2002). The variables will be specific to teacher use of technology in the classroom to facilitate instruction, teacher technology training, teacher and school effects, student perceptions of math ability, and socioeconomic status, which are described in the analytical plan. Each of the instructional technology variables will explore online/offline computer software programs used with traditional face-to-face learning.
The Internet is a ubiquitous resource that continues to change the face of online educational technology. Along with traditional face-to-face instruction, online resources have been used to provide distance learning to millions of students. While the brick-and-mortar schoolhouse and fully online learning models exist apart, blended learning merges the two styles. According to Picciano and Dziuban (2007), scholar-participants in a Sloan-Consortium Workshop in 2005 constructed a dual definition for blended learning as courses: “… that integrate online with traditional face-to-face class activities in planned, pedagogically valuable manner [and] where a portion (institutionally defined) of face-to-face time is replaced by online activity” (Laster, Otte, Picciano, & Sorg, 2005). Horn and Staker (2012) define blended learning as “a formal education program in which a student learns at least in part through online delivery of content and instruction with some element of student control over time, place, path, and/or pace and at least in part at a supervised brick-and-mortar location away from home.” (Horn and Staker, 2012, 5)

Inherent to these definitions is the idea that flexible composite fields of inquiry present opportunities for differentiation of student learning levels with regard to pace and rigor.

Digital Divide

For blended and fully online learning to be effective, academic institutions must have the necessary technological tools, such as computers with Internet access and high-speed broadband, to engage in activity. The crux of this matter is the U.S. digital divide, which denies many Black, Latino/a, low-income and rural K-12 students access to these technological resources. According to Horrigan, in 2013, 22.8% of Black students attended schools with access speeds between 200 Kbps and 10 Mbps and 37% of Black students attend schools with speeds between 200Kbps and 50 Mbps. The National
broadband map (NBM) is a data source compiled by the National Telecommunications and Information Administration and the Federal Communications Commission. Along with the NCES and the U.S. Department of Education, the NBM provides data on K-12 schools broadband service. The NBM has ten categories of service, from the lowest (200 Kbps) to the greatest (greater than 1Gbps). The first five categories of access speeds encompass 200 Kbps to 10 Mbps, the sixth and seventh from 10 to 50 Mbps, the eighth from 50 to 100 Mbps and the ninth and tenth are greater than 100 Mbps (Horrigan, 2014).

The use of online learning tools with slow broadband speed provides inefficient and ineffective environments for technology instruction. Virtual education online programs that are aligned with the National Council of Teachers of Mathematics (NCTM) and Common Core Standards are out of reach for many underrepresented students.

The NCTM stated that teachers and students must have “access to technologies that support and advance mathematical sense making, reasoning, problem solving, and communication” (National Council of Teachers of Mathematics, 2015, p. 1). According to NCTM technological tools are content-specific (“computer algebra systems; dynamic geometry environments; interactive applets; handheld computation, data collection, and analysis devices; and computer based applications”) and content-neutral (“communication and collaboration tools and web-based digital media”).

Rationale

The ELS: 2002 is used in this study because the technological elements outlined for use by Common Core Standards and NCTM stated above (CCSSI, 2014; National Council of Teachers of Mathematics, 2015) were utilized in 2002. This data set offers a nationally representative sample of 1,004 tenth-grade Black males from which to explore
technology use in the classroom, technology training of their teachers, perceptions of math ability and socioeconomic status. The data set is conducive to the formulation of conclusions about how this population learns mathematics with technology.

According to the NCES, about 99% of American public schools had Internet access by 2002. With Internet access came the availability of the virtual manipulatives that were and are still aligned with the Common Core Standards and the NCTM standards. Resources such as Geometer’s Sketchpad and Mathematica provided dynamic geometry environments and computer algebra systems to learners. The calculator and graphing calculator were also present in 2002. In addition, in 2002 some schools were using online and blended learning environments. While the advancement of technology has brought about new iterations of software applications, the intrinsic core values and standards for instructional technology remain as they did in 2002, notwithstanding educational temporalities of change.

The Great Media Debate

Clark, in a meta-analysis of research of forms of 20th century education technology, stated “[Instructional technology] are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition” (Clark, 1983, 445). This position highlights that methods move through the media, but these methods, not the media, are the value in instruction.

Kozma stakes out a contrasting position: Learners make meaning through the use of media resources because they are a part of their learning environment. Kozma
contends that Clark’s delivery truck analogy creates an “unnecessary schism between medium and method” (Kozma, 1994, p. 205). Students take necessary information from the field of inquiry, which is constituted, at least in part, through technological tools. The role of technology is to provide tools that differentiate alternate forms of learning to maximize the representation of cognitive performance tasks.

While the media effects debate has gone on for more than 30 years, with convincing arguments on both sides, global education and the global economy’s growth through technology-rich industry have required the use of computer technology in learning (Pedro, 2012).

The ratio of students to computers with Internet access in public schools in 1998 was 12.1:1, but fell to 7:1 by 2000, 3:1 by 2008 and 1:1 in many schools by 2014 (Wells & Lewis, 2006; Warschauer et al, 2014). With a dramatic increase in the availability of computers in public schools in the last decade, instructional technology research has undergone a paradigm shift to the implementation of technology for effective teaching and learning (Goos, 2014). Mobile technology has expanded from laptops to tablets and personal cellphones to provide here and now access to instructional technology in classrooms (Martin & Ertzberger, 2013).

Common Core State Standards Initiative and Standardized Testing

The Common Core Standards recommend the use of instructional technology that aligns with grade level curricula. According to the Standards, at the end of each year, a standardized assessment is given to all students. Student outcomes present a measurement of the annual state of math and literacy education. For this study, success
in mathematics will be determined by competency on 10th and 12th grade standardized mathematics examinations.

The first known standardized tests were administered in China more than a millennium ago. British colonial administrators introduced them to Europe in the 19th century (Johnson, 2010). According to Johnson, after the 19th century, the standardized competitive examination spread through Western business and education sectors as the best way to “prevent corruption and favoritism” (Kazin et al., 2010, p. 142).

Today’s standardized tests set a benchmark for evaluating student performance (Johnson, 2010). These forms of assessment were designed to increase the accountability of educators for student achievement. The era of education accountability in the United States began in the 1970s, but the National Commission on Excellence in Education’s 1983 report A Nation At Risk has been characterized as the catalyst for standards-based reform (Kok-DeVries, 2011). During the 1990s, state education policymakers began to set standards, and standardized tests were being administered to students all over the country. In 2002, No Child Left Behind enshrined into law that each state must adhere to a set of standards and administer annual standards-based exams to receive federal funding. Later in 2009, the National Governors Association convened a team of education consultants to develop K-12 standards, now the Common Core Standards, for both literacy and numeracy. According to the CCSSI (2014), "the standards are designed to be robust and relevant to the real world, reflecting the knowledge and skills that our young people need for success in college and careers” (CCSSI, 2014, p. 1). While the requirements of NCLB were a statutory mandate, the Common Core Standards are a semi-voluntary initiative. In order for state education departments to receive monies for
their schools, they were obligated to adopt the Common Core State Standards. In 2009, President Obama’s Race to the Top initiative offered points towards their applications for competitive grants to states that implemented value-added teacher evaluations, standards-based curriculum, and testing (Hanushek & Rivkin, 2010).

According to Abbott (2014), standardized tests are categorized as either criterion- or norm-references tests. Criterion-referenced tests use pre-determined standards to measure the performance of test-takers. The Common Core Standards tests, NAEP tests and Advanced Placement (AP) exams are examples these assessments. In other words, if the highest score is a 50, every student could get a 5 if they meet that achievement level. Norm-referenced tests rank students using a score distribution similar to the bell curve. While the questioning of these tests include standards-based content, the scores do not identify if the test-taker met the standards or developed any skills; merely just a curved ranking. Some well-known examples of a norm-referenced test are the SAT and ACT.

Inequities in Standardized Testing

Standards-based testing provides the federal government evidence to make meaningful comparisons of student achievement, which influences how researchers, policymakers and education professionals view the state of education. According to Hanushek and Rivkin (2010), empirically documented data results are aggregated to provide information about each student, class, grade, school, district, or region. These tests, however, do not account for cultural differences in education and community, the rigor of the curriculum, teaching styles, or techniques; they offer baseline analyses
without consideration of factors that may influence performance (Gutierrez & Dixon-Román, 2011).

Martin (2009) explains that gifted Black students in predominantly Black schools are not offered the same advanced coursework or preparation to be as successful on standardized assessments as their White counterparts. Hart, Carman, Luisier and Vasavada (2011) state that higher income and White schools offer an abundance of Advanced Placement (AP) and International Baccalaureate (IB) classes, whereas predominantly Black schools do not. AP and IB classes terminate with a criterion-referenced standards-based exam, which better prepares students for future high-stakes standardized tests. Despite the PSAT, SAT, ACT and post-secondary exams such as the GRE, GMAT, MCAT, LSAT, DAT, being norm-referenced tests, students with a higher level of understanding of content knowledge and vocabulary typically score in the higher quartiles of both tests. According to the College Board (2012) study measuring AP exam scores and PSAT scores, there is a .539 correlation for AP Calculus, .651 for AP Statistics, .762 for English Language and .754 for English Literature. This study showed that the PSAT was useful in determining success on AP exams. Despite the scoring techniques of criterion- and norm-referenced tests, both require students to gain a mastery of standards-based content knowledge and vocabulary to be successful.

To combat inequities in teaching and learning, education scholars have issued a call for culturally responsive mathematics education (Gutierrez & Dixon-Román, 2011; Martin, 2009). Black male students’ poor performance on standardized tests relative to that of White male students provides a quantitative historical truth that has been used to build an ideology of inferiority within the realm of education (Gutierrez, 2008). The use
of empirical data has neglected to take into account the historical and cultural factors that are complicit in the miseducation of Black youth (Martin, 2012). Despite the ongoing scholarly debate over the cultural and racial bias of standardized tests, these assessments are still gatekeepers to higher education and high paying jobs.

Forms of Capital

According to Sirin (2005), standardized test scores and economic and social capital are positively correlated. Students from higher SES backgrounds perform better on standardized exams than students with lower SES. SES is among the most salient factors that contribute to inequalities in educational opportunities. Coleman (1966) states that economic capital and background are the greatest predictors of academic achievement in the United States. Bourdieu (1977) states that low socioeconomic status and the possession of a non-dominant form of social or cultural capital have the greatest impact on success in dominant cultural fields. Non-dominant cultural capital is the currency of lower SES communities. “Racial and ethnic groups create cultural boundaries to demarcate both intergroup and intragroup differences” (Carter, 2003, p. 138). Impoverished Black males, as members of lower SES communities, are more likely to possess a non-dominant form of cultural capital, which is not readily accepted by school authority and may keep them out of the social network. Bourdieu (1977) finds that schools reward students on the basis of their cultural capital, defined “as instruments for the appropriation of symbolic wealth socially designated as worthy of being sought and possessed” (Bourdieu, 1977, p. 488). Success in schools is positively related to the possession of social capital (DiMaggio, 1982). Without dominant social and cultural
capital, Black males are ill-equipped to make gains in fields of dominant culture such as education, employment, and health care.

Wacquant (2012) conducts a sociological analysis of the urban Black community, highlighting the dialectical opposition of control/confinement and security/integration. The social action of the ghetto is geared against the dominant forms of social capital, where inhabitants find safety and togetherness as an oppressed group. While there are social benefits to identifying with non-dominant actions in one’s community, taking these ways of being to dominant fields may disallow agency into many areas, including education. Lack of education for Black males, more often than with other groups, leads to the low-wage job market and possibly to criminal behavior and incarceration.

By increasing social and cultural capital, Black males can overcome the obstacles to higher SES and academic achievement. DiMaggio (1982) believes that those with higher SES possess more social and cultural capital, which leads to higher levels of educational attainment. He describes cultural and social capital as inherited qualities that parents pass down to their children so that they can obtain access to that capital. DiMaggio states that one of the reasons Black male youth have difficulty in school is that they have not inherited or developed a need for the cultural capital that would allow them to excel.

Schools, purposed to produce human capital for their nation’s job market, are learning environments rooted in their society’s dominant social and cultural capital. In the United States, students from marginalized groups negotiate school experiences that align or misalign with their social norms and pre-existing social and cultural capital. When the facilitation of learning by educators only validates forms of knowledge from a
White canonical education system (Gutierrez, 2011), students from marginalized groups may see their knowledge as deficient. The consequences of teachers’ inability to make connections to students threatens engagement, agency and achievement.

**Student Perception of Math Ability**

With regard to student outcomes, the statistical significance of SES levels trumps race, yet Sirin (2005) describes SES and race as linked in the United States. Racial inequality has long been an issue in America (Mickelson & Greene, 2006). In regard to education, highly racialized experiences have undermined student agency in the pursuit of academic opportunities. These negative experiences have become the framework for the parenting of marginalized school children. Students that have developed negative attitudes toward learning demonstrate poor academic performance. According to Van de Grift (2007), students’ attitude and behavior towards mathematics stems from their successes. Van de Grift states that student perceptions of mathematical ability are highly correlated with their past and current achievement. McGee (2009) points to the negative perceptions of mathematical ability that Black parents pass down to their children; White and Asian parents pass down positive perceptions to their children. Given the history of Black inequality in American schools, it is likely that race plays a role in the way(s) that various forms of capital are operationalized in schooling. Lareau and Horvat (1999) find that:

some Black parents, deeply concerned about the historical legacy of discrimination against Blacks in schooling, approach the school with open criticisms. Since educators seek a positive and deferential role for parents in schooling, race appears to play an independent role in parents’ ability to comply
with educators’ requests ... The findings suggest the importance of focusing on moments of inclusion and exclusion in examining how individuals activate social and cultural capital (p. 37).

Ogbu (1998) developed a classification of minorities as voluntary or involuntary. Voluntary refers to minorities that moved to the United States willingly for opportunities better than those presented in their homeland. Involuntary minorities are people “who have been conquered, colonized, or enslaved” (Ogбу, 1998, p.165). These groups were forced to become a part of the framework of United States against their will and see Whites as their oppressors. Ogbu (1998) points out that this classification is not one of race but of history; Blacks are an involuntary minority because they were brought to the United States as slaves and not because they are Black. This population experiences different psychological and emotional perspectives of American life as a permanent underclass. Black students cope with dominant patterns of social action to different degrees as they negotiate American life as involuntary minorities.

Coleman (1966) states that predominantly Black schools have ill-equipped facilities, a high concentration of non-degree teachers and low achievement at all K-12 levels. Historically, Black learners have been neglected and have past on their negative school experiences to their children. The child enters the classroom with anticipation of racialized experiences; the social actions of the class then become what Martin (2009) calls racialized forms of experience. Martin (2009) posits that for Black learners, the teaching and learning of mathematics should be contextualized and examined in a framework of race, identity, resilience and agency. This classifies learning of
mathematics and active participation as a racialized experiences. Martin (2009) states that racialized forms of experience encompass:

…experiences in which the socially constructed meanings of race in society emerge as highly salient structuring (1) the way that mathematical experiences and opportunities to learn unfold and are interpreted, and (2) the manner in which mathematics literacy and competency are framed, including who is perceived to be mathematically literate and who is not (p. 324).

The hope of their research framework was to examine learners “identity-related conceptions of race and participations” (Berry & Thunder, 2015) in order to gain access to the factors contributing to their success.

Relevant Studies

Wood (2014) presented a study of qualitative interviews involving 28 Black male community college students to identify the role of perceptions in their academic engagement and performance. In this study, Black male students discussed introversion, lack of focus and anxiety to meet heightened expectations as issues that contributed to their performance. Some participants felt a high level of apprehension to engage as active agents in the classroom perceiving that the students and teachers would see them as “stupid, ignorant, dumb or retarded” (Wood, 2014, 796). The negative perceptions of academic ability and academic disengagement, expressed by Black male respondents, led to a lack of identification with their peers and teachers as a part of the class. Students with negative perceptions were less likely to ask for help, participate in classroom activities or engage in interaction with faculty members (Wood, 2014). It is important for
teachers to discover ways to actively engage their students and foster a safe environment for learning. When students perceive a favorable classroom climate, they are more likely to contribute to classroom activities and ask for assistance when necessary.

Seeking help from teachers and peers is a self-regulated learning strategy that contributes to success in completing tasks. With regard to mathematical learning, Ryan and Shim (2012) state that students that seek help in classroom settings perform better than those who do not and have more positive self-perception of their academic abilities. Schenke et al., (2015) present a quantitative analysis of the relationship between student perception of classroom environmental influences and math achievement. This examination of 3,897 high schools students used hierarchical linear modeling to interpret the relationship between help-seeking tendencies, standardized mathematics scores and student perceptions of the classroom climate. This study concluded that students that perceived more emotional support from classroom agents, asked for more help from teachers and peers and showed significant positive gains on math standardized tests.

Student perception of math ability is a multifaceted phenomenon rooted in two domain-specific constructs: self-concept and self-efficacy. Mathematics self-concept encompasses “knowledge and perceptions about oneself with respect to mathematics” and mathematics self-efficacy involves the “convictions about oneself with respect to mathematics performance” (Weckbacher & Okamoto, 2014, 59). The attitude of students toward mathematics stems from a collection of beliefs about their ability and their confidence to accomplish performance tasks. In a quantitative analysis of the relationship between mental rotation ability and self-perceptions of high school geometry students (Weckbacher & Okamoto, 2014), state that student self-perception of math
ability was positively aligned with mental rotation ability. Mental rotation is the ability to manipulate well-structured visual images; a skill widely used in STEM content areas.

Access to STEM Jobs

According to Atkinson (2013), many of the Science, Technology, Engineering and Mathematics (STEM) jobs are not filled in the United States, due to a lack of quality workers. Holdren and Lander (2012) state that less than 40% of students that attempt a STEM degree complete it. Education policymakers, practitioners and researchers have looked for ways to improve the teaching and learning of STEM content areas by changing curricula, introducing new forms of technology, and training teachers and school support staff. While these initiatives explore how the growth and development of school-level agents impact student outcomes, student attitudinal-level factors must not be overlooked. The sociopolitical and sociocultural experiences of students in their school and community environments are an important part of how they self-conceptualize their academic abilities. Factors such as focus, motivation, engagement, grit and perseverance have shown positive correlations with high levels of academic performance and positive perceptions of math ability (Deberard et al., 2004; Wang, 2009). The relationship of the prefaced interrelated factors and the literature that follows has influenced the use of student perception of math ability as a research domain for this study.

According to NCES (2011), most minority and low-income youth do not have STEM foundational content skills to compete with their White counterparts. Furthermore, “there are significant gaps in achievement between student population groups: “the Black/White, Hispanic/White, and high-poverty/low-poverty gaps are often
close to 1 standard deviation in size” (National Research Council, 2011, 3). With so many STEM jobs out of reach for these unique populations, research must find what methods work best to improve achievement in these content areas.

**Culturally Responsive Pedagogies**

Out of these inequities, research regarding culturally responsive math education theory attempts to account for the successes of Black males in mathematics education and highlight the need for mathematics that values the knowledge gained from students’ culture (Gutierrez & Dixon-Román, 2011). Standards-based education provides a one-size-fits-all solution to education that is based on a Western canonical cultural format. This instructional and testing bias does not account for non-dominant cultural knowledge from outside of school, which could cultivate positive attitudes and perceptions of mathematics. Gutierrez and Dixon-Román (2011) theorize that the achievement gap compares the academic outcomes of marginalized students to White, middle-class students within the cultural framework of an educational system designed for Whites. Blacks should be compared to other Blacks, and researchers should endeavor to understand how Black students construct knowledge. Martin (2009) states that the recognition of issues of race and culture in education will allow for the development and implementation of culturally responsive pedagogies.

**Teacher/School Effects**

According to the National Center for Education Statistics (NCES) (2014), in 2014 the percentage of White public and private school teachers in the US rose to approximately 83%, while the percentage of White students was less than 50%. The NCES projections indicate that enrollments of ethnic minorities will continue to increase
over the next decade. With changes in the racial and cultural demographic of students, there comes the need for teachers to explore sociocultural elements that contribute to the teaching and learning of mathematics. An examination of the factors that affect academic achievement requires an understanding of the interactions between students and their teachers. Education research suggests that relationships between these agents are important to teaching and learning (Pianta et al., 2008).

Allen (2015) analyzed data from interviews of teachers of Black male secondary school students. This qualitative study observed, reported and interpreted the ideologies and practices of teachers of this marginalized population. The interview process revealed that teachers recognized a disconnect between the home and school culture of their Black male students. The teachers also mentioned stereotyping and negative labeling of students by their colleagues. According to Chavous et al., 2004, evidence of negative stereotypes negatively affects the academic self-concept of Black males. Teachers reported that disciplinary actions were more severe for this group; “black males were criminalized and denied opportunities to learn” (Allen, 2015, 75).

In-Service Technology Initiatives for Educators

Thomas and Palmer (2014) explore the use of digital technology in classrooms and the role played by the teacher. With new educational technology comes the need for training initiatives and teacher cooperation. They argue that technology classrooms with the teacher-facilitator at its center highlight the need for training that is rooted in pedagogical technology knowledge. In-service teacher training is a difficult task to add to the list of requirements already demanded of instructors. Although professional
development several times a year is a requirement for most school systems, many teachers find themselves ill-equipped to cope with the demands of technology-based curricula. According to Heid et al., (2013) many extrinsic and intrinsic factors affect teacher technology implementation. The extrinsic factors are high-stakes testing and the perceptions of students and parents. The intrinsic factors are the perceptions of educators and their ability to implement technology. Thomas and Palmer (2014) used a 10-year longitudinal study of secondary mathematics teachers to draw conclusions concerning technology use in the teaching and learning of mathematics. They found that teachers were unable to create learning environments that were rich in pedagogy, content knowledge, and technology. Thomas and Palmer (2014) conclude that by helping teachers build awareness of and confidence in learning technology, they can transform classroom practices to maximize their instructive skill set.

Pre-Service Technology Initiatives for Educators

Initiatives to increase education technology skills have included the use of Technological Pedagogical Content Knowledge (TPACK), a pre-service framework designed to prepare teachers to understand and make use of the interplay of area content knowledge, pedagogical practices, and technology use to support and enhance teaching and learning (Archambault & Crippen, 2009; Tokmak, 2014). In addition, professional development for in-service teachers has been used to build knowledge and culture of technology use for student-centered learning (Lei & Zhao, 2007; Tokmak, 2014).

The use of Responsive Classroom (RC) pedagogy and teaching techniques has been used to foster the development of positive classroom interactions. While a RC may improve interactions between classroom agents, teachers must also consider meeting the
Common Core Standards national mathematics objectives. Scholars have investigated the use of the RC approach to determine the level at which it contributes to the use of standards-based mathematics teaching practices. Ottmar et al., (2015) state that two teaching skills are required to create standards-based math learning environments; the first is to guide interactions using tasks, math knowledge and math discourse and the second is the facilitation of social interactions between all the agents in their learning environment. The dialectical interplay of these two skills allow for a field of inquiry where social and academic connections presuppose one another.

Tawfeeq and Yu (2012) present the development of a methods course to provide training in culturally responsive mathematics education. As a Black professor of mathematics education supervising a group of five White pre-service teachers, Tawfeeq used cogenerative dialogue to observe and analyze the teachers’ perspectives on race, culture, and mathematics education. They state that one of his course goals was to provide scholarly literature to help pre-service teachers engage students from diverse backgrounds. Two components framed the course, Socio-Cultural Pragmatic Mathematics Methods (S-CPM):

- Culturally pragmatic diversities may lead to misunderstandings and communication breakdowns in the course of classroom communication. These misunderstandings have practical consequences.
- Pragmatic conventions or norms of appropriate behavior in a given mathematics classroom may have to do with cultural values, beliefs, or with situational factors (Tawfeeq & Yu, 2012, p. 31).
In the course students conducted 25 hours of field observations and with their professor created a protocol to examine the classroom environment, review high-level mathematics, and serve Black and Latina/o secondary school students. The secondary school students came from a local school and participated in discussions with the pre-service teachers for 14 weeks. In the discussion groups, students described incidents pertaining to race and culture in their mathematics classroom. Tawfeeq and Yu suggest that while students explained their own racialized experiences and inequities in education, the pre-service teachers used SES and not race or culture as a determinant of low performance levels. Each course student, however, contributed his or her reflections at the conclusion of the course, expressing improved ability to use higher-level math knowledge to explain related concepts at a lower level, and an appreciation for the experiences of urban students.

Conclusion

Despite the positive correlation in student outcomes to high SES, the redistribution of wealth in the United States is not realistic. Instead, this paper will research elements that offer educators and educational policymakers more pragmatic solutions; it will investigate the use of technological elements in the mathematics classroom, which offer Black students greater success in learning mathematics. It will also endorse newer initiatives, which may support the development of culturally responsive mathematics education.
2.4 Contribution to the Field

Previous instructional technology research has focused on student outcomes with regard to access to technological devices, systems and professional development, teacher perceptions of technology use and training, phenomenological one-to-one teacher interviews, teacher focus groups, meta-didactical transposition modeling, and other ethnographic measures. These studies have shown that when technology is used well and student attitudes are positive, student learning improves. This study will focus on what math teachers are doing with the technology that works for Black male students. Prior research indicates that educational inequities have persisted for Black male students through low to medium-level technology, while this research will take into account the Common Core Standards adopted by most of the country to predict proficiency in mathematics through the use of low to high-level technology. Findings of this study will identify the predictors for Black male success through forms of technology use that align with the Common Core Standards.
Chapter 3: Methods

This chapter presents the dataset, methodology and procedure used for this dissertation. It includes strategies employed to negotiate these structures to allow this dissertation to answer salient questions regarding Black male student outcomes in math with instructional technology.

3.1 Introduction

The first chapter of this dissertation provides an exploration of the technology skills-based global economy, citing significant government investments made by countries for the use of education technology. The United States’ response to low production of globally competitive human capital was the development of the Common Core standards in English language arts and mathematics. The Common Core standards provide rigorous and challenging standards for teaching and learning. Most importantly, these standards state that proficiency in secondary school mathematics requires understanding how to use many forms of high-level education technology. The Common Core initiatives are currently being used by an overwhelming number of states’ K-12 student population for this 2015-2016 academic school year. Historically, marginalized groups in the United States have produced much lower educational outcomes in traditional face-to-face environments with low-level technological resources. The poor academic achievement of Black males has been well documented by scholars. As this at-risk population transitions into new curricular initiatives that require the use of high-level technology, it is important to understand how Black male students learn with these resources. This research examines how this unique population learns with high-level
technology to promote awareness, influence policy and support future study to best
prepare secondary school Black male students for success on annual Common Core
standardized assessments.

The second chapter presents the theoretical lenses used to examine the factors
contributing to success in math for Black male students as follows: Bourdieu’s cultural
and social capital, Coleman’s cultural capital and social action, Martin’s equity-based
math education, and Gutierrez’s socio-political mathematics. The ELS:2002 longitudinal
survey dataset is used in this quantitative dissertation to identify the statistical
significance of each element of the hypotheses developed earlier.

The ELS:2002 base year student survey required student respondents to provide
information regarding instructional technology usage in their math classroom and their
self-perception of math ability. In addition, student participants took standardized math
tests during the base year and follow-up surveys. The base year teacher survey asked the
math teachers of the student respondents about their race, gender, years of teaching
experience, highest level of education and technology training. The base year
administrator questionnaire requested information regarding the urbanicity, school type.
The parent base year survey was used to create the latent variable socioeconomic status
from the guardian’s highest level of education, annual income and occupation. This
nationally representative sample of 15,362 students and their math teachers, presents an
excellent opportunity to better understand how students are learning with technological
resources. Additional factors, student perception of math ability, teacher/school effects
and socioeconomic status, were examined in this dissertation; scholars have found that
these phenomena contribute to student scholastic performance (reference). The depth and
breadth of the ELS:2002 dataset and the research herein will produce findings salient to
the development of generalizations about how Black male secondary students learn
mathematics with technology.

The domain variables for this dissertation were chosen based on an in-depth
review of literature related to Black male student achievement and corresponding
variables available in the ELS:2002 dataset for public-use. SPSS 22 statistical software
was used to upload data and perform bivariate and multivariate analysis. T-tests,
ANOVA, Pearson Correlation and OLS regression analyses were used to determine the
degree to which the prefaced domain variables affect Black male student math
achievement.

3.2 Dataset

The NCES provided public-use data files of the base and follow-up years of the
Education Longitudinal Survey of 2002 (ELS:2002) on their website available for
download for statistical analysis. All data used for this dissertation is from the public-use
files mentioned and came from student, parent, teacher and administrator responses and
student cognitive test battery.

The Education Longitudinal Survey of 2002 (ELS:2002) is the fourth of the five
Secondary Longitudinal Studies Program (SLSP). While the High School Longitudinal
Study of 2009 (HSLS:09) was the latest iteration of the SLSP, it maintained no
questioning of the use of education technology in the math classroom or the technology
training of math teachers. With a need to examine the affect of education technology on
Black male student math performance, the technology domain variables presented in the ELS:2002 dataset were employed to properly investigate this phenomena.

The National Education Longitudinal Studies program was instituted by the National Center for Education Statistics (NCES) in order to “collect and disseminate statistics and other data related to education in the United States” (Act source here). This program was developed to study the educational, psychological and social development of students throughout their secondary education and post-secondary education and/or employment. The datasets gathered offer information regarding the individual, school/institutional and familial/cultural factors which impact academic and social development of adolescents into adulthood.

There are currently four completed high school longitudinal studies programs:

2. High School and Beyond longitudinal study of 1980 (HS&B)

The fifth study, the High School Longitudinal Study of 2009 (HSLS:09) has completed two collection waves, with a second follow-up planned for 2016 and a fourth in 2021. The NCES uses these datasets for longitudinal analysis of gains in scholastic achievement and the correlate factors of those gains for inter-cohort and cross-cohort comparison.

While the inter-cohort comparison in each longitudinal study explores and explains the growth and transitions of each representative group over a decade, the cross-cohort comparison allows researchers to interpret the impact of factors affecting educational outcomes over four decades.
The National Longitudinal Study of the High School Class of 1972 (NLS:72) followed 19,001 students from their senior year of high school for 14 years. Students were randomly selected from 1,061 schools across the United States to complete six waves of student questionnaires and a battery of cognitive tests. Post-secondary transcripts from academic and vocational institutions were also collected in 1984 for this cohort. The final fifth follow-up was given in 1986.

The High School & Beyond longitudinal study began in 1980 surveying both a sophomore cohort and a senior cohort of high school students. A two-stage probability sample was used for base year sample collection; over 1,000 schools were the first-stage units and 58,000 students were the second-stage units. Both groups completed student questionnaires every two years until 1986; the sophomore cohort was surveyed in 1992 as well. This study differed from the NLS:72 in that it collected survey data from teachers, principals and a subsample of parents. The postsecondary transcripts for the sophomore class extended well into 1993.

The National Education Longitudinal Study of 1988 (NELS:88) was launched with 25,599 8th grade students from 1,052 schools. This study began with 8th grade students to provide a measure of student achievement prior to entrance to high school. Base year student respondents were required to fill out questionnaires and take assessments in math, science, reading and social studies. The teachers (math and English), principal, and one parent of each student were also surveyed. The questionnaires were designed to better understand the individual, school and familial-level factors that predict educational and occupational outcomes over many years. The
data provided research opportunities for longitudinal analysis of student achievement and the factors that affected gains.

The NELS:88 first follow-up in 1990 resurveyed students, teachers and principals. This follow-up represented student participants as well as dropouts. The dropout data was collected to find predictors that influence student attrition. The second follow-up in 1992 and third follow-up in 1994 requested post-secondary education and occupational information from student respondents. The high school transcripts were collected during the second follow-up. The fourth follow-up in 2000 collected information about family structure, employment, postsecondary transcripts, and postsecondary life experiences.

The Education Longitudinal Study of 2002 (ELS:2002), like the SLSP studies which preceded it, was designed to study the performance and experiences of high school students. This study began with a nationally representative sample of 15,362 sophomores. It followed with subsamples of the base year participants that chose to continue in the study for remaining follow-up and postsecondary transcript retrieval.

The fifth study in the SLSP, the High School Longitudinal Study of 2009 (HSLS:09), began with a nationally representative sample of 21,444 ninth grade students. It was the first SLSP study to employ the use of computer-based questionnaires in schools for student participants and web-based surveys for teacher, guidance counselor, administrator and teacher respondents. This study includes four follow-up iterations. In 2012, a follow-up survey was administered to the cohort of then mostly 11th graders and dropouts. The follow-up in 2013, during what would be the senior year for most students, collected postsecondary information. The NCES plans to administer two
additional follow-ups in 2016 and 2021; the last two iterations will collect postsecondary transcripts and/or occupational experiences.

3.3 Analytic Samples

The Educational Longitudinal Study of 2002 (ELS: 2002) is a nationally representative dataset that tracked the progress of American adolescents through their secondary and post-secondary academic and professional careers. The United States Department of Education’s National Center for Education Statistics (NCES) conducted this major longitudinal effort using a two-stage sample selection process. First, 1221 eligible schools were selected using stratified probability proportional to size (PPS) out of 27,000 schools across the nation. Only 752 of the 1221 eligible schools were used in the study. Second, employing a flow basis for a stratified systematic sample of students, approximately 26 sophomores were selected from each school. The selection process resulted in 15,362 base year student respondents. The base year of this study began in 2002, surveying students, teachers, parents, administrators and other school staff during their 10th grade academic year. The first follow-up was in 2004 during their 12th grade year (this wave included students who have dropped-out or were held back). The remaining survey waves were the second follow-up in 2006 and the third follow-up in 2012.

The ELS: 2002 is appropriate for this dissertation due to its multiple respondent population design. Students, parents and school staff respondents offer policy-relevant data to provide a comprehensive view of the factors that impact student outcomes. This dissertation will analyze and interpret data provided by each student respondent and from
their parent and math teacher respondents from the base year. An examination of the survey data shows that Black males students have an N = 1004.

3.4 Measures

The statistical analyses for this dissertation were retrieved from the NCES ELS:2002 public-use data files. This longitudinal study employed a cognitive test battery during both the base and follow-up years in mathematics, which are used as dependent variables for this dissertation. The independent variables are sectioned into five domains: use of instructional technology, teacher technology training, student perception of math ability, teacher/school effects and socioeconomic status. The ELS:2002 public-use data files contain the manifest variables from each individual survey and latent variables created upon the thorough consideration of the NCES researchers which compiled, organized and cleaned the original dataset. All variables used for this dissertation were uploaded, recoded and analyzed through the use of SPSS 22 statistical software. The subsections that follow will discuss the aforementioned variables in greater detail.

3.4.1 Dependent Variables

As mentioned earlier, forty-three states of K-12 students in the United States have adopted the Common Core Standards (CCSSI, 2014). These standards require that all students take an annual standardized assessment in English language arts and mathematics at the end of each school term. The results of these exams are used to evaluate student performance, teacher quality and overall school standards accountability (Johnson, 2010). To measure success in math this dissertation uses student respondent standardized math scores from the 2002 and 2004 cognitive test battery. The first
dependent variable for this dissertation is the students’ 10th grade mathematics standardized test score (BYXMSTD), extracted from the base year survey data set. The second dependent variable is the students’ 12th grade mathematics standardized test score (F1XMSTD), extracted from the follow-up year survey data set.

Math tests contained items in arithmetic, algebra, geometry, data/probability, and advanced topics and were divided into process categories of skill/knowledge, understanding/comprehension, and problem solving. (Ingels et al., 2004, 18)

Test bank questions from the NELS:88, NAEP, and PISA were used for this assessment to keep consistency and continuity with previous cognitive tests. These interval level variables were chosen as predictors of success in mathematics for this unique population.

Although these tests have been shown to exhibit cultural and racial bias for marginalized groups in the United States (Gutierrez, 2008; Martin, 2009, 2012; McGee, 2009), these assessments remain the gatekeepers to high school graduation, higher education and high paying jobs.

3.4.2 Independent Variables

As mentioned earlier, the independent variables used in this study exist in the following five domains:

1. Use of Instructional Technology
2. Teacher Technology Training
3. Student Perception of Math Ability
4. Teacher/School Effects
5. Socioeconomic Status

The first domain, use of instructional technology, represents how students use computer resources in the math classroom. The second domain, teacher technology training,
quantifies the amount and level of math technology training of each teacher. The third domain, student perception of math ability, examines students’ math self-efficacy. The fourth domain, teacher/school effects, measures the teacher-level and school-level variables that may contribute to achievement. The fifth domain, socioeconomic status, illustrates the effect of economic, social and cultural capital on student performance.

The global market has demanded its workers to possess a high level of skill in STEM content areas in order to be competitive in the global workforce. Since the 1990’s, there has been a tremendous increase in the development and use of instructional technology in the United States to prepare youth for STEM jobs (Cheung & Slavin, 2013). The Common Core Standards, in response to American students’ low standing on the international academic stage, has described proficiency in math to encompass the mastery of a multitude of instructional technology applications and tools. As education technology initiatives are integrated into math curricula, teacher professional development courses train teachers to use these new resources. According to CCSSI (2014), accountability requires that math standardized tests be the benchmark for success in math. According to NCES (2011), most minority and low-income youth do not have the STEM foundational content skills to compete with their White counterparts. Furthermore, “there are significant gaps in achievement between student population groups: “the Black/White, Hispanic/White, and high-poverty/low-poverty gaps are often close to 1 standard deviation in size” (National Research Council, 2011, 3). This represents a crisis in education for these marginalized groups. This dissertation will investigate how the use of instructional technology in classrooms and the technology
training of teachers influence the math achievement of a nationally representative sample of Black male secondary students.

3.4.2.1 Domain Variables

In order to examine instructional technology use in the math classroom, eight variables were extracted from the ELS: 2002 base year data set via SPSS 22 statistical software. These variables accounted for the frequency of student computer use to:

1. review math work
2. solve math problems
3. graph
4. practice math drills
5. analyze data, apply learning
6. be instructed one-on-one
7. to show new topics

The aforementioned variables are BYS31A-H respectively. Factor analysis was performed using SPSS 22 statistical software determine if the eight observed variables could be merged to a lower number of components. This analysis signaled that all eight manifest variables fell under one component. A mean variable was computed via SPSS 22 into one unobserved variable coded as Instructional Technology. Instructional Technology is the product of all observed variables aligning under one component via factor analysis with a Cronbach Alpha reliability of .882.
For technology training of teachers, six training variables were extracted from the ELS: 2002 public-use base year data set via SPSS 22 statistical software. These variables accounted for training received in:

1. basic math computer skills
2. math software applications
3. use of Internet for math resources
4. other math technology
5. integrating math technology into lessons
6. follow-up or advanced training

The aforementioned variables are BYTM38A-F respectively. These six nominal, two category variables were combined using SPSS 22 count function to produce an interval level variable coded as Teacher Training.

According to Weckbacher & Okomoto (2014), student perceptions of math ability are significant to academic achievement. Students’ attitude toward mathematics stems from a collection of beliefs about their ability and their confidence to accomplish performance tasks. Wood (2014) states that Black males with high levels of engagement and positive perceptions of math ability exhibit high levels of academic performance.

The variable Perception of Math Ability involved the use of five variables extracted from the ELS: 2002 base year data set via SPSS 22 statistical software. These variables accounted for students’ confidence and knowledge to:

1. do excellent on math tests
2. understand difficult math texts
3. understand difficult math instruction
4. do excellent on math assignments
5. to master skills in their math class

The aforementioned variables are coded as BYS89A, BYS89B, BYS89L, BYS89R, BYS89U respectively. Factor analysis was performed using SPSS 22 statistical software to determine if the five observed variables could be merged to a lower number of components. This analysis signaled that all five manifest variables fell under one component. A mean variable was computed via SPSS 22 into one unobserved variable coded as Perception of Math Ability. Perception of Math Ability is the product of all observed variables aligning under one component via factor analysis with a Cronbach Alpha reliability of .933.

The ELS:2002 public-use dataset contained information about the gender, race, education and years of teaching experience provided by each math teacher respondent. The gender of the math teacher, BYTM22, is coded Male “1” and Female “2”. This variable is recoded for this study to a dummy variable FEMALE, where male is “0” and female is “1”. The race of the math teacher, BYMRACE, is coded “1” for American Indian/Alaska Native, “2” for Asian, Hawaii/Pacific Islander, “3” for Black or African-American, “4” for Hispanic (no race specified), “5” for Hispanic (race specified), “6” for More than one race (non-Hispanic) and “7” for White, (non-Hispanic). This variable is recoded for this study to a dummy variable TXWHITE, where all non-White teachers are “0” and White teachers are “1”. The education of each math teacher was coded as an interval level variable BYTMHDEG, which ranged from: “1” for No Degree, “2” for Associates Degree, “3” for Bachelor’s Degree, “4” for Education
Specialist/Professional Diploma, “5” for Master’s Degree, “6” for Doctorate Degree and “7” for 1st Professional Degree (M.D., J.D.). The teaching experience of student’s math teachers was provided through an interval level variable, BYTM26C with a range from one to forty years of teaching experience.

This dataset also contained school-level variables regarding the urbanicity of the school and the school type. Information regarding urbanicity was maintained via the variable BYUBERAN, where “1” for Urban, “2” for Suburban, “3” for Rural. Using SPSS 22, this nominal/3-category variable was recoded into two dummy variables SUBURBAN, where non-suburban is coded “0” and suburban is coded “1” and RURAL where non-rural is coded “0” and rural is coded “1”. The school type was represented by BYSCTRL, where “1” for Public, “2” for Catholic, “3” for Other Private. Using SPSS 22, this nominal/3-category variable was recoded into a dummy variable coded PUBLIC, where private and Catholic schools are coded “0” and public schools are coded “1”.

Socioeconomic status is a latent variable, BYSES1, created by the primary NCES research group based information provided by parent respondents regarding their family income, highest level of education and occupation prestige score.

3.5 Analytical Strategy

As mentioned earlier, all statistical analyses of the ELS:2002 public-use data files were performed via SPSS 22 statistical software. The NCES website was used to download the aforementioned data files and upload them to SPSS 22 using the sps format option. A thorough sweep of the uploaded data files revealed that many variables relevant to this dissertation contained missing, survey component legitimate skip and
non-applicable values. These values were reassigned as missing values via SPSS 22 and relevant variables were examined via the univariate descriptives program component. After an extensive review of the dataset, the dependent and independent variables were chosen and recoded as described earlier in this chapter.

In order to isolate Black male secondary students, demographic variables for both race and sex were used to filter out this unique population from the nationally representative sample of students. Using SPSS 22, BYRACE (variable for student race) was used to filter my sample by Black or African-Americans via the filter command prompt. BYRACE is coded “1” for American Indian/Alaska Native, “2” for Asian, Hawaii/Pacific Islander, “3” for Black or African-American, “4” for Hispanic (no race specified), “5” for Hispanic (race specified), “6” for More than one race (non-Hispanic) and “7” for White, (non-Hispanic). The same filtering procedure was used for the sex of the student respondent variable, BYSEX. BYSEX is coded “1” for Male and “2” for Female. Once demographic filtering produces a sample of 1004 Black male respondents, command prompts were used in SPSS 22 in order to perform bivariate and multivariate analyses for this study.

The bivariate and multivariate analyses performed in this dissertation was solely dependent on variable categorical classification of nominal, ordinal and interval/ratio and the number of categories therein.

3.5.1 Bivariate Tests for T-Test ANOVA and Pearson’s r

The dummy variable PUBLIC was analyzed using a T-Test. As a 2-category nominal variable, a t-test provides a bivariate examination to compare both 10th and 12th
grade standardized test score means of public versus non-public school Black male students.

As previously mentioned, the dummy variables SUBURBAN and RURAL were used to represent urbanicity. The original variable BYURBAN is a 3-category nominal variable. An ANOVA was used to provide an analysis to compare both 10th and 12th grade standardized test score means of urban versus suburban versus rural Black male students.

To discover relationships between interval/ratio (I/R) variables used in this study a pearson’s correlation was employed to measure the linear correlation between each pair of I/R variables. A pearson’s correlation is used for the following variables: 10th grade standardized math score, 12th grade standardized math score, instructional technology, technology training, perception of math ability, teacher’s highest degree, years of teaching experience and socioeconomic status.

3.5.4 OLS Regression Analysis

The dependent variables chosen, 10th and 12th grade standardized test scores, represent Black male student math achievement. Based on the two dependent variables interval/ratio classification, OLS regression was used. This dissertation used hierarchical linear modeling in order to illustrate the degree of variance the independent variable domains, as nested models, impact each dependent variable.

The independent variables were chosen in response to the deficit-filled discourse of Black male student achievement with instructional technology. While the use of technology in classrooms and the training of teachers in technology are the focal domains
for this dissertation, there are other factors that scholars have shown contribute to academic achievement which include: perception of math ability, teacher/school effects and socioeconomic status.

According to Wood (2012), educators must be inclined to find ways to encourage and motivate students to engage in learning by promoting positive student-teacher relationships. In regard to this study’s Black male population, many students have difficulty learning with math instruction rooted in Western canonical culture and ideology (Martin, 2012). As prefaced in the literature review, the National Center for Education Statistics (2014) offers that in 2014 the percentage of White public and private school teachers in the US rose to approximately 83%. The NCES projects that majority of students will be ethnic minorities within the next decade. These shifts in the racial and cultural demographic of students, signal the need for teachers to explore sociocultural elements that contribute to the teaching and learning of mathematics (Gutierrez, 2008; Martin, 2009, 2012). This factor was examined using White Math Teacher, a dummy variable created with Race of Math Teacher (BYMRACE).

Martin (2009) expressed that predominately Black schools have high teacher attrition rates resulting in a less experienced teaching faculty. This highlights a lack of highly qualified instructors for the nation’s lowest performing population. According to Martin (2009) Black, Latino/a and low-income students have educators with the lowest qualifications in STEM content area subjects and continue to be at risk for low student outcomes. To better understand the impact of teaching experience, the variable BYTM26C was recoded to Years of Teaching Math.
According to Horrigan (2014), students in Black/Latino/a and rural schools have broadband speeds far lower than suburban students. The impact of urbanicity was explored by creating two dummy variables from the variable BYURBAN: Suburban and Rural. This allows for an understanding of how this digital divide impacts learning with instructional technology.

To account for the inequities in teacher qualifications, this dissertation used the variable Highest Degree Attained by Math Teacher (BYTMHDEG) to understand the effects of teacher experience on student outcomes.

McGee (2009) discusses the lack of male education professionals in Black schools; theorizing the value of male role models for this marginalized population. This dissertation explores this issue using the variable Female Math Teacher. This is a dummy variable created via Sex of Math Teacher (BYTM22).

As prefaced in the literature review, Sirin (2005) posits that students from higher SES make greater academic gains and have more opportunities for academic growth. The socioeconomic status of students is analyzed using the variable Socioeconomic Status, which was recoded from BYSES1. According to Coleman and Hoffer (1987), students that are sent to private and catholic school tend to have better student-teacher relationships, parental support, lower class sizes and greater scholastic outcomes than public school students. For this factor the variable Public was used; a dummy variable created from BYSCTRL.

As previously mentioned, this dissertation consists of five independent variable domains: use of instructional technology, teacher technology training, student perception
of math ability, teacher/school effects and socioeconomic status. Each domain maintains the specific variables outlined earlier in this chapter. They were placed in nested models in four separate regression analyses. With education technology use and teacher technology training both mark the focus of this study, four regressions were necessary to understand how each of the two technology components, with student perception of math ability, teacher/school effects and socioeconomic status nested in each regression, explain variance in both 10th and 12th grade standardized tests. The first two regressions measured the base year 10th grade standardized test scores and 12th grade standardized test scores respectively against use of instructional technology, perception of math ability, teacher/school effects and socioeconomic status respectively. The third and fourth regression measured the base year 10th grade standardized test scores and 12th grade standardized test scores respectively against training in instructional technology, perception of math ability, teacher/school effects and socioeconomic status respectively. SPSS was used to code and receive outputs of all four regression via regression command prompts.

Through the use and interpretation of bivariate (T-Tests, ANOVA, Pearson’s Correlation) and multivariate analyses (OLS Regression), this dissertation will suggest improvements to the technological framework of the mathematics classrooms for this unique population.
Chapter 4: Results

This chapter interprets SPSS data analysis with an emphasis on the prefaced relationships between variables. Findings of bivariate (T-tests, Anova and Pearson’s r) and multivariate (OLS regression) analyses displayed and explained herein represent relationships, which mark statistical significance to the .05 level or higher.

4.1 Introduction

This dissertation employs the use of t-tests and ANOVA to compare means of standardized test scores to categorical independent variables, Pearson’s r for correlations of continuous variables and OLS regression to examine changes in standardized test scores with respect to both dummy and continuous independent variables. For t-tests, ANOVA and OLS regression, as previously mentioned in the methods chapter, 10th and 12th grade standardized test scores are the continuous dependent variables chosen to represent Black male student math achievement.

In this research, the base year and first follow-up year of the ELS: 2002 dataset for public use were used for all data analysis. Upon download from the NCES website, data was uploaded to SPSS 22, cleaned and recoded as necessary to run all tests. T-tests, ANOVA, Pearson’s r and OLS regression tests were run through command syntax and interpreted through output features.

The use of technology in classrooms and the training of teachers in technology are the two focal domains for this dissertation. There are four regression sequences, two examining the use of technology in classrooms and additional predictor variables against 10th and 12th grade standardized tests scores and two examining the training of teachers in
technology and additional predictor variables against 10\textsuperscript{th} and 12\textsuperscript{th} grade standardized tests scores. Each regression sequence maintains four regression models with each nested in the next. The additional domains of predictor variables are as follows: perception of math ability, teacher/school effects and socioeconomic status. For the OLS regression, 16 models were generated via SPSS. Success in 10\textsuperscript{th} grade and 12\textsuperscript{th} grade mathematics was applied as a function of the 4 domains mentioned above. The change in each dependent variable was calculated via OLS regression. The first four models were designed to measure the affect of each of the independent variables (focal domain is technology use in classroom) on 10\textsuperscript{th} grade math scores for the Black male population. The second four models were designed to measure the affect of each of the independent variables (focal domain is technology use in classroom) on 12\textsuperscript{th} grade math scores for the Black male population. The third four models were designed to measure the affect of each of the independent variables (focal domain is the training of teachers in technology) on 10\textsuperscript{th} grade math scores for the Black male population. The fourth four models were designed to measure the affect of each of the independent variables (focal domain is the training of teachers in technology) on 12\textsuperscript{th} grade math scores for the Black male population.

For the prefaced 16 models, the regression coefficients are used to identify the changes in the dependent variable based on every unit increase in the independent variable. In addition, $R^2$ tells us the percentage of variance in the dependent variable is due to the independent variables.
**Table 4.1 Means, Standard Deviation, Ranges and Description of Variables for Black Males**

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>Range</th>
<th>Description: ELS Variable NAME and Label</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics Standardized Score in 2002</td>
<td>1004</td>
<td>44.8</td>
<td>8.60</td>
<td>19.9 – 74.9</td>
<td>BYXMSTD ‘BY Mathematics Standardized Score’</td>
</tr>
<tr>
<td>Mathematics Standardized Score in 2004</td>
<td>768</td>
<td>45.1</td>
<td>8.60</td>
<td>24.7 – 73.7</td>
<td>F1XMSTD ‘F1 Mathematics Standardized Score’</td>
</tr>
<tr>
<td><strong>Instructional Technology</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of Instructional Technology</td>
<td>247</td>
<td>2.77</td>
<td>1.24</td>
<td>1-5</td>
<td>Mean of 8 items: from BYS31A ‘Respondent uses computers to review work’ thru BYS31H ‘Respondent uses computer to show new topics’</td>
</tr>
<tr>
<td><strong>Technology Training</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology Training</td>
<td>1004</td>
<td>.322</td>
<td>2.31</td>
<td>0-6</td>
<td>Count Variable from 6 items: from BYTM38A ‘Respondent’s Basic Computer Skills Training’ thru BYTM38F ‘Respondent’s Follow-up/Advanced Training’</td>
</tr>
<tr>
<td><strong>Student Perceptions of Math Ability</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student Perceptions of Mathematical Ability</td>
<td>573</td>
<td>2.56</td>
<td>.827</td>
<td>1-4</td>
<td>Mean of 5 items: BYS89A ‘Respondent can do excellent on tests’, BYS89B ‘Respondent understands difficult math texts, BYS89L ‘Respondent understands in difficult math class’, BYS89R ‘Respondent does excellent job on math assignments’, BYS89U ‘Respondent can master math class skills’</td>
</tr>
<tr>
<td>Variable</td>
<td>N</td>
<td>Mean</td>
<td>S.D.</td>
<td>Range</td>
<td>Description: ELS Variable NAME and Label</td>
</tr>
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<td>------</td>
<td>-------</td>
<td>--------------------------------------------------------</td>
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<tr>
<td><strong>Teacher Effects</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highest Degree Earned by Math Teacher</td>
<td>774</td>
<td>4.05</td>
<td>1.02</td>
<td>2-7</td>
<td>BYTMHDEG ‘Highest Degree Attained’</td>
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<tr>
<td>Sex of Math Teacher (Female)</td>
<td>771</td>
<td>.573</td>
<td>.495</td>
<td>0-1</td>
<td>FEMALE ‘Dummy Variable from BYTM22 ‘Teacher’s Sex’</td>
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<td>Race of Teacher (White)</td>
<td>768</td>
<td>.727</td>
<td>.446</td>
<td>0-1</td>
<td>TXWHITE ‘ Dummy Variable from BYMRACE ‘Teacher’s Race’</td>
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<td>Total Years of Teaching K-12 Math</td>
<td>758</td>
<td>16.1</td>
<td>11.1</td>
<td>1-40</td>
<td>BYTM26C ‘How Long Respondent has Taught Math K-12’</td>
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<tr>
<td>Suburban</td>
<td>1004</td>
<td>.392</td>
<td>.489</td>
<td>0 - 1</td>
<td>SURBURBAN ‘Dummy Variable from BYURBAN ‘suburban school’</td>
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<tr>
<td>Rural</td>
<td>1004</td>
<td>.127</td>
<td>.333</td>
<td>0 - 1</td>
<td>RURAL ‘ Dummy Variable from BYURBAN ‘rural school’</td>
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<td>Public</td>
<td>1004</td>
<td>.888</td>
<td>.316</td>
<td>0 - 1</td>
<td>PUBLIC ‘Dummy Variable from BYSCTRL ‘School Control’</td>
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<td><strong>SES</strong></td>
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<tr>
<td>Socioeconomic Status</td>
<td>1004</td>
<td>-.201</td>
<td>.680</td>
<td>-1.78 - 1.80</td>
<td>BYSES1 'Socio-economic status composite'</td>
</tr>
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</table>
Table 4.2 Comparison of Means on Math Standardized Score in 2002 and 2004 by Independent Variables for Black Males (n_i in parenthesis)

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Math Score in 2002</th>
<th>Math Score in 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School Control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>44.3***</td>
<td>44.5***</td>
</tr>
<tr>
<td></td>
<td>(891)</td>
<td>(670)</td>
</tr>
<tr>
<td>Private/Catholic</td>
<td>48.3</td>
<td>49.5</td>
</tr>
<tr>
<td></td>
<td>(113)</td>
<td>(98)</td>
</tr>
</tbody>
</table>

***p=.001

Note: Within each predictor on the dependent variable, the superscript of the level of statistical significance is placed just on one of the two categories to indicate that the relative mean scores are statistically different from each other.

Table 4.3 Comparison of Means on Math Standardized Score in 2002 and 2004 by Independent Variables for Black Males (n_i in parenthesis)

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Math Score in 2002</th>
<th>Math Score in 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urbanicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>44.6</td>
<td>45.5</td>
</tr>
<tr>
<td></td>
<td>(483)</td>
<td>(358)</td>
</tr>
<tr>
<td>Suburban</td>
<td>44.9</td>
<td>44.8</td>
</tr>
<tr>
<td></td>
<td>(394)</td>
<td>(310)</td>
</tr>
<tr>
<td>Rural</td>
<td>45.1</td>
<td>44.7</td>
</tr>
<tr>
<td></td>
<td>(127)</td>
<td>(100)</td>
</tr>
</tbody>
</table>
Table 4.4 Pearson’s Correlations for Black Males

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics Standardized Score in 2002</td>
<td>1</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Mathematics Standardized Score in 2004</td>
<td>.859***</td>
<td>1</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Use of Instructional Technology</td>
<td>-.192</td>
<td>-.249*</td>
<td>1</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Technology Training</td>
<td>.245*</td>
<td>.207</td>
<td>-.042</td>
<td>1</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Student Perceptions of Math Ability</td>
<td>.045</td>
<td>.082</td>
<td>.138</td>
<td>-.097</td>
<td>1</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Highest Degree Earned by Teacher</td>
<td>-.073</td>
<td>-.053</td>
<td>.153</td>
<td>.015</td>
<td>.136</td>
<td>1</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Total Years of Teaching K-12 Math</td>
<td>-.061</td>
<td>-.039</td>
<td>.125</td>
<td>-.139</td>
<td>.206</td>
<td>.255*</td>
<td>1</td>
<td>---</td>
</tr>
<tr>
<td>Socioeconomic Status</td>
<td>.365***</td>
<td>.399***</td>
<td>-.096</td>
<td>.109</td>
<td>-.065</td>
<td>-.087</td>
<td>.130</td>
<td>1</td>
</tr>
</tbody>
</table>

*p=.05    ***p=.001

Note: Within each predictor on the dependent variable, the superscript of the level of statistical significance is placed just on one of the two categories to indicate that the relative mean scores are statistically different from each other.
Table 4.5 Regression Coefficients (Beta in parentheses) for Mathematics Standardized Score in 2002 for Black Males \((N = 116)^a\)

<table>
<thead>
<tr>
<th></th>
<th>Model I</th>
<th>Model II</th>
<th>Model III</th>
<th>Model IV</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Instructional Technology</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instructional Technology</td>
<td>-1.02†</td>
<td>-1.09†</td>
<td>-1.02</td>
<td>-.949*</td>
</tr>
<tr>
<td></td>
<td>(-.155)</td>
<td>(-.166)</td>
<td>(-.156)</td>
<td>(-.144)</td>
</tr>
<tr>
<td><strong>Student Perceptions of Math Ability</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perception of Math Ability</td>
<td>1.31</td>
<td>1.22</td>
<td>1.53†</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.139)</td>
<td>(.129)</td>
<td>(.162)</td>
<td></td>
</tr>
<tr>
<td><strong>Teacher/School-Level Effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher’s Highest Degree</td>
<td>.281</td>
<td>.490</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.036)</td>
<td>(.062)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female Math Teacher</td>
<td>1.49</td>
<td>2.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.090)</td>
<td>(.126)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White Math Teacher</td>
<td>1.86</td>
<td>2.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.102)</td>
<td>(.109)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Years Teaching Math</td>
<td>.010</td>
<td>.036</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.014)</td>
<td>(.049)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>-4.17</td>
<td>-2.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(-.105)</td>
<td>(-.071)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urbanicity (Ref: Urban)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suburban</td>
<td>.450</td>
<td>.830</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.027)</td>
<td>(.050)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>2.20</td>
<td>3.19</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.101)</td>
<td>(.146)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socioeconomic Status</td>
<td>3.89***</td>
<td></td>
<td></td>
<td>.318</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>(.318)</td>
</tr>
<tr>
<td>Constant</td>
<td>44.9</td>
<td>41.9</td>
<td>41.8</td>
<td>38.5</td>
</tr>
<tr>
<td>Adjusted (R^2)</td>
<td>.015</td>
<td>.026</td>
<td>.004</td>
<td>.096</td>
</tr>
<tr>
<td>(F)</td>
<td>2.81†</td>
<td>2.55†</td>
<td>1.05</td>
<td>2.22*</td>
</tr>
</tbody>
</table>

\(a\) Information above is based on a listwise deletion of cases.

\(†p < .1\)  \(*p < .05\)  \(**p < .001\)
Table 4.6 Regression Coefficients (Beta in parentheses) for Mathematics Standardized Score in 2004 for Black Males (N = 80)

<table>
<thead>
<tr>
<th></th>
<th>Model V</th>
<th>Model VI</th>
<th>Model VII</th>
<th>Model VIII</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Instructional Technology</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instructional Technology</td>
<td>-1.66* (.249)</td>
<td>-1.77* (.266)</td>
<td>-1.91* (.287)</td>
<td>-1.68* (.252)</td>
</tr>
<tr>
<td><strong>Student Perceptions of Math Ability</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perception of Math Ability</td>
<td>1.16 (.119)</td>
<td>1.55 (.158)</td>
<td>1.38 (.141)</td>
<td></td>
</tr>
<tr>
<td><strong>Teacher/School-Level Effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher’s Highest Degree</td>
<td>-.384 (.048)</td>
<td>-.141 (.018)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female Math Teacher</td>
<td>-1.20 (.071)</td>
<td>.479 (.029)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White Teacher</td>
<td>1.72 (.088)</td>
<td>2.65 (.135)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Years Teaching Math</td>
<td>-.023 (.032)</td>
<td>.020 (.028)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>-2.47 (.073)</td>
<td>-.884 (.026)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urbanicity (Ref: Urban)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suburban</td>
<td>-.360 (.022)</td>
<td>.335 (.020)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>1.66 (.075)</td>
<td>3.84 (.173)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socioeconomic Status</td>
<td></td>
<td></td>
<td>5.02*** (.431)</td>
<td></td>
</tr>
<tr>
<td><strong>Constant</strong></td>
<td>47.1</td>
<td>44.5</td>
<td>47.5</td>
<td>42.9</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>.050</td>
<td>.052</td>
<td>-.011</td>
<td>.158</td>
</tr>
<tr>
<td>F</td>
<td>5.17*</td>
<td>3.17*</td>
<td>.903</td>
<td>2.49*</td>
</tr>
</tbody>
</table>

*a Information above is based on a listwise deletion of cases.

*p < .05    ***p < .001
Table 4.7 Regression Coefficients (Beta in parentheses) for Mathematics Standardized Score in 2002 for Black Males (N = 431)<sup>a</sup>

<table>
<thead>
<tr>
<th></th>
<th>Model IX</th>
<th>Model X</th>
<th>Model XI</th>
<th>Model XII</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technology Training</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology Training</td>
<td>-.300</td>
<td>-.262</td>
<td>-.100</td>
<td>-.053</td>
</tr>
<tr>
<td></td>
<td>(-.057)</td>
<td>(-.050)</td>
<td>(-.019)</td>
<td>(-.010)</td>
</tr>
<tr>
<td><strong>Student Perceptions of Math Ability</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perception of Math Ability</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.33***</td>
<td>2.39***</td>
<td>2.36***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.217)</td>
<td>(.222)</td>
<td>(.220)</td>
<td></td>
</tr>
<tr>
<td><strong>Teacher/School-Level Effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher’s Highest Degree</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.142</td>
<td>.258</td>
<td>.142</td>
<td>.258</td>
</tr>
<tr>
<td></td>
<td>(.016)</td>
<td>(.030)</td>
<td>(.016)</td>
<td>(.030)</td>
</tr>
<tr>
<td>Female Math Teacher</td>
<td>-.730</td>
<td>-.474</td>
<td>-.041</td>
<td>-.027</td>
</tr>
<tr>
<td></td>
<td>(-.041)</td>
<td>(-.074)</td>
<td>(-.041)</td>
<td>(-.074)</td>
</tr>
<tr>
<td>White Math Teacher</td>
<td>1.59†</td>
<td>1.59†</td>
<td>1.59†</td>
<td>1.59†</td>
</tr>
<tr>
<td></td>
<td>(.080)</td>
<td>(.080)</td>
<td>(.080)</td>
<td>(.080)</td>
</tr>
<tr>
<td>Total Years Teaching Math</td>
<td>-.062</td>
<td>-.051</td>
<td>-.062</td>
<td>-.051</td>
</tr>
<tr>
<td></td>
<td>(-.078)</td>
<td>(-.064)</td>
<td>(-.078)</td>
<td>(-.064)</td>
</tr>
<tr>
<td>Public</td>
<td>-4.55***</td>
<td>-3.03*</td>
<td>-4.55***</td>
<td>-3.03*</td>
</tr>
<tr>
<td></td>
<td>(-.175)</td>
<td>(-1.16)</td>
<td>(-.175)</td>
<td>(-1.16)</td>
</tr>
<tr>
<td>Urbanicity (Ref: Urban)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suburban</td>
<td>.916</td>
<td>1.08</td>
<td>.916</td>
<td>1.08</td>
</tr>
<tr>
<td></td>
<td>(.051)</td>
<td>(.060)</td>
<td>(.051)</td>
<td>(.060)</td>
</tr>
<tr>
<td>Rural</td>
<td>1.54</td>
<td>2.17†</td>
<td>1.54</td>
<td>2.17†</td>
</tr>
<tr>
<td></td>
<td>(.057)</td>
<td>(.080)</td>
<td>(.057)</td>
<td>(.080)</td>
</tr>
<tr>
<td><strong>SES</strong></td>
<td></td>
<td></td>
<td></td>
<td>3.44***</td>
</tr>
<tr>
<td>Socioeconomic Status</td>
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<td></td>
<td></td>
<td>(.283)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>46.6</td>
<td>40.5</td>
<td>42.7</td>
<td>40.8</td>
</tr>
<tr>
<td>Adjusted R&lt;sup&gt;2&lt;/sup&gt;</td>
<td>.001</td>
<td>.046</td>
<td>.082</td>
<td>.156</td>
</tr>
<tr>
<td>F</td>
<td>1.42</td>
<td>11.4***</td>
<td>5.28***</td>
<td>8.97***</td>
</tr>
</tbody>
</table>

<sup>a</sup> Information above is based on a listwise deletion of cases.

†p < .1  *p < .05  ***p < .001
Table 4.8 Regression Coefficients (Beta in parentheses) for Mathematics Standardized Score in 2004 for Black Males (N = 323)a

<table>
<thead>
<tr>
<th></th>
<th>Model XIII</th>
<th>Model XIV</th>
<th>Model XV</th>
<th>Model XVI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technology Training</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology Training</td>
<td>-.289</td>
<td>-.253</td>
<td>-.130</td>
<td>-.141</td>
</tr>
<tr>
<td></td>
<td>(-.058)</td>
<td>(-.050)</td>
<td>(-.026)</td>
<td>(-.028)</td>
</tr>
<tr>
<td><strong>Student Perceptions of Math Ability</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perception of Math Ability</td>
<td>2.34***</td>
<td>2.64***</td>
<td>2.53***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.212)</td>
<td>(.239)</td>
<td>(.229)</td>
<td></td>
</tr>
<tr>
<td><strong>Teacher/School-Level Effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher’s Highest Degree</td>
<td>.082</td>
<td>.067</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.009)</td>
<td>(.008)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female Math Teacher</td>
<td>-.1.13</td>
<td>-.823</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(-.063)</td>
<td>(-.046)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White Math Teacher</td>
<td>.653</td>
<td>.899</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.032)</td>
<td>(.043)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Years Teaching Math</td>
<td>-1.10*</td>
<td>-.096*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(-.138)</td>
<td>(-.120)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>-4.19**</td>
<td>-2.30†</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(-.173)</td>
<td>(-.095)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urbanicity (Ref: Urban)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suburban</td>
<td>-.468</td>
<td>-.131</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(-.026)</td>
<td>(-.007)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>.164</td>
<td>1.62</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.006)</td>
<td>(.057)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socioeconomic Status</td>
<td>4.68***</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>(.385)</td>
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<td></td>
<td></td>
</tr>
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<td>47.4</td>
<td>41.2</td>
<td>45.2</td>
<td>43.5</td>
</tr>
<tr>
<td><strong>Adjusted R²</strong></td>
<td>.000</td>
<td>.042</td>
<td>.085</td>
<td>.224</td>
</tr>
<tr>
<td><strong>F</strong></td>
<td>1.07</td>
<td>8.10***</td>
<td>4.34***</td>
<td>10.3***</td>
</tr>
</tbody>
</table>

*a Information above is based on a listwise deletion of cases.

†p < .1    *p < .05    **p < .01    ***p < .001
4.2 Bivariate Tests: T-Test, ANOVA and Pearson’s r

A t-test was used to compare the means of the dummy variable Public and Private/Catholic. The t-test which is labeled as Table 4.5 illustrates that the means of public and Private/Catholic are statistically different from each other at a level $p < .001$ with regard to both 10th and 12th grade standardized test scores.

An ANOVA was run to compare the means of urbanicity dummy variables: Suburban and Rural. The ANOVA is labeled as Table 4.6. The ANOVA determined that no groups are significantly different from one another with regard to both 10th and 12th grade standardized math test scores.

A Pearson’s r was run to discover the correlations between continuous variables and is labeled as Table 4.7. This comparative test showed that many relationships were statistically significant. 10th and 12th grade standardized math scores showed a strong positive correlation (.859) significant to the $p<.001$ level. Socioeconomic status showed a moderately weak positive correlation significant to the $p<.001$ level to both 10th and 12th grade standardized math scores (.365 and .399 respectively). Instructional Technology and 12th grade standardized math scores showed a weak negative correlation (-.249) significant to the $p<.05$ level. Lastly, Total Years Teaching Math and Teacher’s Highest Degree showed a weak positive correlation (.255) significant to the $p<.05$ level.
4.3 Regression Analysis of 10th Grade Scores with Technology Use in Classroom

The summary analysis for Models I through IV are in Table 4.1. These Models in this focal domain predict the changes in 10th grade scores based on technology use in classroom and independent variables. The 10th grade student respondents have an N = 116. This population size is due mainly to legitimate skip items, missing items and independent variables.

Models I through IV comprise a four-step regression process. Each Model represents the addition of a new domain. After the first Model, which maintains the focal domain (technology use in classroom), each Model thereafter nests each of the remaining three predictor variables. Model I contains technology use in classroom, Model II contains technology use in classroom and perception of math ability, Model III contains technology use in classroom, perception of math ability and teacher/school Model IV contains technology use in classroom, perception of math ability, teacher/school effects and socioeconomic status. This process of nesting variables in Models allows the analysis to account for the complexity of factors with regards to student math test scores. The results are summarized in Table 4.1.

4.3.1 Instructional Technology

OLS regression analysis has demonstrated that student use of instructional technology in the classroom is significant for Model IV at the .05 level. When controlling for all other variables, for every unit increase in use of instructional technology, the math test scores of Black male students decreases .949 units. For Models I and II, student use of instructional technology in the classroom is approaching
significance. When controlling for all other variables, for every unit increase in use of instructional technology, the math test scores of Black male students decrease 1.02 units in Model I. When controlling for all other variables, for every unit increase in use of instructional technology, the math test scores of Black male students decrease 1.09 units for Model II. In summary, when instructional technology is accompanied with all the nested variables test scores decrease.

4.3.2 Covariates

The introduction of student perception of math ability into Models II through IV demonstrate an increase in student test scores, despite their lack of statistical significance. However, in Model IV this domain approaches significance. When controlling for all other variables, for every unit increase in student perception of math ability, the math test scores of Black male students increase 1.53 units.

Models III and IV introduce seven variables that make up teacher/school effects. The regression analysis shows that these variables offer no statistical significance with relation to student outcomes.

Model IV presents socioeconomic status as the last variable nested. Based on previously mentioned research, Sirin (2005) socioeconomic status is a powerful variable that usually trumps all other factors contributing to educational phenomena. Due to its strength it was introduced into every regression in the final Model. When controlling for all other variables, for every unit increase in socioeconomic status, the math test scores of Black male students increase by 3.89 units. The statistical significance of socioeconomic status is at a level where p < .001.
In summary, as predicted socioeconomic status is the largest predictor of student math success with a p < .001. Student perception of math ability was the second largest predictor of success in math with a p < .1. In concert with the use of standardized beta coefficients to understand the relationships explained above, unstandardized beta coefficients are highest with socioeconomic status at .318 and perception of math ability at .162. Additionally, the adjusted R2 for Model IV is .096. This shows that 9.6% of the variance in 10th grade standardized math test scores is due to the independent variables. This low value is addressed in the limitations.

4.4 Analysis of 12th Grade Scores with Technology Use in Classroom

The summary analysis for Models V through VIII are in Table 4.2. The Models of this focal domain predict the changes in 12th grade scores based on technology use in classroom and independent variables. The 12th grade student respondents have an N = 80. This population size is due mainly to legitimate skip items, missing items and of independent variables.

Models V through VIII comprise the same four-step regression process outlined in Table 4.2. Each Model represents the addition of a new domain. After the first Model, which maintains the focal domain (technology use in classroom), each Model thereafter nests each of the remaining three predictor variables. Model V contains technology use in classroom, Model II contains technology use in classroom and perception of math ability, Model III contains technology use in classroom, perception of math ability and teacher/school Model IV contains technology use in classroom, perception of math ability, teacher/school effects and socioeconomic status. This process of nesting
variables in Models allows the analysis to account for the complexity of factors with regards to student math test scores. The results are summarized in Table 4.2.

4.4.1 Instructional Technology

Through the use of regression analysis, student use of instructional technology in the classroom is significant for Model I through IV at the .05 level. In Model I, for every unit increase in use of instructional technology, the math test scores of Black male students decreases 1.66 units. In Model II, for every unit increase in use of instructional technology, the math test scores of Black male students decreases 1.77 units. In Model III, for every unit increase in use of instructional technology, the math test scores of Black male students decreases 1.91 units. In Model IV, for every unit increase in use of instructional technology, the math test scores of Black male students decreases 1.68 units. In summary, instructional technology alone and with nested variables demonstrate a significant decrease in test scores for this unique population. Therefore, this variable is not a relevant factor for increasing student achievement.

4.4.2 Covariates

The introduction of student perception of math ability into Models II through IV show an increase in student test scores, despite their lack of statistical significance. When controlling for all other variables, for every unit increase in student perception of math ability, the math test scores of Black male students increase: 1.16 units in Model II, 1.55 units in Model III and 1.38 units in Model IV.

Models III and IV introduce seven variables that make up teacher/school effects. The regression analysis shows that these variables offer no statistical significance with
relation to student outcomes. While there is no statistical significance in Models III and IV, when controlling for all other variables, for every unit increase in

Model IV presents socioeconomic status as the last variable nested. When controlling for all other variables, for every unit increase in socioeconomic status, the math test scores of Black male students increase by 5.02 units. The statistical significance of socioeconomic status is at a level where \( p < .001 \).

In summary, as predicted socioeconomic status is the largest predictor of student math success with a \( p < .001 \). Student perception of math ability was the second largest predictor of success in math. In concert with the use of standardized beta coefficients to understand the relationships explained above, unstandardized beta coefficients are highest with socioeconomic status at .431, perception of math ability at .141 and having a White teacher was at .135. Additionally, the adjusted R2 for Model IV is .158. This shows that 16% of the variance in 12th grade standardized math test scores is due to the independent variables.

**4.5 Analysis of 10th Grade Scores with Teacher Technology Training**

The summary analysis for Models IX through XII are in Table 4.3. These Models of this focal domain predict the changes in 10th grade scores based on teacher technology training and independent variables. The analytic sample size for this regression is 431 students. This population size is due mainly to legitimate skip items, missing items and of independent variables.

Models IX through XII comprise the same four-step regression process outlined in 4.2. Each Model represents the addition of a new domain. After the Model IX, which
maintains the focal domain (teacher technology training), each Model thereafter nests each of the remaining three predictor variables. Model IX contains teacher technology training, Model X contains teacher technology training and perception of math ability, Model XI contains teacher technology training, perception of math ability and teacher/school and Model XII contains teacher technology training, perception of math ability, teacher/school effects and socioeconomic status. This process of nesting variables in Models allows the analysis to account for the complexity of factors with regards to student math test scores. The results are summarized in Table 4.3.

4.5.1 Technology Training

Through the use of regression analysis, teacher technology training is not statistically significant for Models IX through XII. As teacher’s training in instructional technology increased, the standardized math scores of Black male students decreased.

4.5.2 Covariates

The introduction of student perception of math ability into Models X through XII show a p<.001 level of statistical significance. When controlling for all other variables, for every unit increase in student perception of math ability, the math test scores of Black male students increase: 2.33 units in Model X, 2.39 units in Model XI and 2.36 units in Model XII.

Models XI and XII introduce seven variables that make up teacher/school effects. The regression analysis shows that of these variables public has a statistical significance of p<.001 for Model XI and p<.05 for Model XII. When controlling for all other variables, for every unit increase in public, the math test scores of Black male students
decrease: 4.55 units in Model XI and 3.03 units in Model XII. In addition, having a White math teacher approaches significance for both Models XI and XII and rural respondents approach significance in Model XII.

Model XII presents socioeconomic status. When controlling for all other variables, for every unit increase in socioeconomic status, the math test scores of Black male students increase by 3.44 units. The statistical significance of socioeconomic status is at a level where $p < .001$.

In summary, as predicted socioeconomic status is the largest predictor of student math success with a $p<.001$. Student perception of math ability was the second largest predictor of success in math. In concert with the use of standardized beta coefficients to understand the relationships explained above, unstandardized beta coefficients are highest with socioeconomic status at .283, perception of math ability at .220 and having a White teacher was at .080. Additionally, the adjusted $R^2$ for Model XII is .156. This shows that 16% of the variance in 12th grade standardized math test scores is due to the independent variables.

4.6 Analysis of 12th Grade Scores with Teacher Technology Training

The summary analysis for Models XIII through XVI are in Table 4.4. The Models predict the changes in 12th grade scores based on teacher technology training and independent variables. The analytic sample size for this regression is 323 students. This population size is due mainly to legitimate skip items, missing items and of independent variables.
Models XIII through XVI comprise the same four-step regression process outlined in 4.3. Each Model represents the addition of a new domain. After the Model XIII, which maintains the focal domain (teacher technology training), each Model thereafter nests each of the remaining three predictor variables. Model XIII contains teacher technology training, Model XIV contains teacher technology training and perception of math ability, Model XV contains teacher technology training, perception of math ability and teacher/school and Model XVI contains teacher technology training, perception of math ability, teacher/school effects and socioeconomic status. This process of nesting variables in Models allows the analysis to account for the complexity of factors with regards to student math test scores. The results are summarized in Table 4.4.

4.6.1 Technology Training

Through the use of regression analysis, teacher technology training is not statistically significant for Models XIII through XVI. As teacher’s training in instructional technology increased, the standardized math scores of Black male students decreased.

4.6.2 Covariates

The introduction of student perception of math ability into Models XIV through XVI show a p<.001 level of statistical significance. When controlling for all other variables, for every unit increase in student perception of math ability, the math test scores of Black male students increase: 2.34 units in Model XIV, 2.64 units in Model XV and 2.53 units in Model XVI.
Models XV and XVI introduce seven variables that make up teacher/school effects. The regression analysis shows that of these variables total years teaching math has a statistical significance of $p<.05$ for Models XV and XVI and public has a statistical significance of $p<.01$ for Model XV and approaches significance for Model XVI. When controlling for all other variables, for every unit increase in total years teaching, the math test scores of Black male students decrease: .110 units in Model XV and .096 units in Model XVI. When controlling for all other variables, for every unit increase in public, the math test scores of Black male students decrease: 4.19 units in Model XV and .096 units in Model XVI.

Model XVI introduces socioeconomic status. When controlling for all other variables, for every unit increase in socioeconomic status, the math test scores of Black male students increase by 4.68 units. The statistical significance of socioeconomic status is at a level where $p < .001$.

In summary, as predicted socioeconomic status is the largest predictor of student math success with a $p<.001$. Student perception of math ability was the second largest predictor of success in math. In concert with the use of standardized beta coefficients to understand the relationships explained above, unstandardized beta coefficients are highest with socioeconomic status at .385, perception of math ability at .229. Additionally, the adjusted $R^2$ for Model XVI is .224. This shows that 22.4% of the variance in 12th grade standardized math test scores is due to the independent variables.
4.7 Summary of Results

This chapter presented the findings of this research across 16 regression Models. There were many patterns identified regarding the variance of 10th and 12th grade standardized test scores of Black male students due to the independent domain variables. While the significance of some variables was shown to have more of an affect than others, a clearer picture of these phenomena with respect to success in math has been presented. The \( R^2 \) for each of the four regression sequences revealed the variance in the dependent variable explained by the independent variables. As previously mentioned, these values ranged from: 9.6% (Models I-IV), 15.8% (Models V-VIII), 15.6% (Models IX-XII), and 22.4% (Models XIII-XVI). These results show that there are still many factors which may offer more insight into the variance of testing outcomes for this unique population. Through the use of relevant literature and the prefaced results, the next chapter will discuss these findings.
Chapter 5: Discussion of Results

This chapter explores and explains the findings of this dissertation through the lens of literature relevant to student outcomes with respect to domain variables: use of instructional technology, teacher technology training, student perception of math ability, teacher/school effects and socioeconomic status. Major findings of scholars, which support or refute the interpretations of this dissertation, will be used to understand the factors which contribute to academic achievement for this population.

5.1 Introduction

This dissertation explores the relative importance of instructional technology (implementation by teachers and training for teachers), student perception of math ability, teacher and school effects, and socioeconomic status on high school math scores for Black males. In order to make predictions with regard to this phenomenon, the use of bivariate and multivariate analyses were employed. Findings from the current study illustrate significant differences in 10th and 12th grade math test scores over all four domains. This chapter presents an interpretation of the aforementioned significant findings from chapter four in the context of relevant literature.

As mentioned in the chapter three, the dependent variables chosen, 10th and 12th grade standardized test scores, represent Black male student math achievement. OLS regression was utilized for this dissertation based on the interval/ratio classification of the two dependent variables. OLS regression, also referred to as hierarchical linear modeling, was employed to illustrate the degree to which the variance of the independent variable domains, as nested models, impact each dependent variable. The choice of
independent variables for this dissertation was in response to the deficit-filled discourse of Black male student achievement with instructional technology. While technology in classrooms and the training of teachers in technology are the focal domains for this dissertation, relevant literature provide insight into factors that scholars have shown contribute to academic achievement which include: perception of math ability, teacher/school effects and socioeconomic status. These factors serve as the independent variables for the four regression analyses used in this dissertation. The use of OLS regression highlights the significant differences in 10th and 12th grade standardized test scores of Black males by the aforementioned independent variables.

5.2 Standardized Test Scores and Use of Instructional Technology

Controlling for all other variables, in Model IV, Black male students using instructional technology are more likely to get lower 10th grade standardized test scores. When controlling for all other variables, in Model VIII, Black male students using instructional technology are more likely to get lower 12th grade standardized test scores. The unstandardized beta coefficients are similar across Models I-IV and V-VIII identifying instructional technology as a robust predictor variable for a lack of achievement for both regression analyses. These results align with relevant literature with regard to teacher integration of technology in chapter two revisited below.

According to the NCTM (2015), students must have access to technological tools that support the teaching and learning of mathematics. The United States digital divide is a phenomenon that serves as a barrier to academic success with education technology for this unique population. Horrigan (2014) states that while schools may have the
technological hardware, they lack sufficient broadband speeds in predominately Black schools. This deficit disallows academic agency to web-based resources that require greater broadband speeds in order to be effective tools. The digital divide is an affront to the NCTM mandate and the Common Core Standards mathematical practices which both outline proper use of technology for proficiency in mathematics.

Technological resources present an opportunity for students to differentiate learning (Kozma, 1994); allowing students to choose from many forms of knowledge rooted in traditional math concepts. Jimoyiannis & Komis (2007) state that while ICT in education provides great opportunities for teaching and learning, teacher use of technology is positively correlated to teacher beliefs of the effectiveness of the resources provided.

Smith (2014) posits that predominately Black schools lack technological hardware and software resources as well as experienced and highly certified math teachers. This population has less experienced teachers and lower quality facilities. The inability of teachers to effectively integrate technology to foster success in learning environments may explain low student outcomes.

Branch (2015) states that students require deeper understandings of core math concepts and technology use. In a study of the affects of bridging project-based learning with technology, Branch (2015) found that the growth in mathematics achievement scores were statistically significant compared to that of traditional instruction when teachers were effectively trained and provided support.
In a study involving the use of connected classroom technologies (CCTs) to help support formative assessment practices, Shirley & Irving (2014) found evidence of student achievement. Formative assessment practices involve layering instructional elements so that teachers can monitor student understanding and adapt to the needs of students. Connected classroom technologies maintain a group of devices that form an interactive learning experience that monitors student learning for teachers and students to gauge their level of understanding. These tools are shown to work only when student teacher relationships are positive and teacher implementation is effective.

Schools of high-income students boast the effective use of interactive whiteboards, computer algebra programs, tablets, etc., while schools with low-income students have a lower teacher quality and less effective implementation of technology (Levine & Levine, 2014; Smith, 2014). According to Engel & Green (2011), the proper use of technology in classrooms leads to high levels of motivation and greater outcomes for students. Engel & Green (2011) allowed pre-calculus students to use cellphone devices to participate in classroom blogs, websites for sharing photos, and electronic voting. Students were given research projects to complete with their cellphones and shared information on blogs. The teachers were able to gauge student understanding from their posts and students provided peer-to-peer instruction through blog contributions and collaborations. The anonymity involved in this study bolstered student participation and initiative.

While instructional technology has been shown to increase student outcomes when used properly, inequities in teacher quality, school facilities and technological resources have negatively affected the education of Black males. The unequal
distribution of the aforementioned educational elements, supported by the findings and literature illustrate the need for an improvement in the teaching and learning of this population. In a mixed methods study of science secondary school in New York City, McNamara (2013) found that access to the resources necessary for proper STEM education were provided based on the demographic and socioeconomic status of students in schools.

5.3 Standardized Test Scores and Technology Training

Controlling for all other variables in this study, in Model XII, math teachers’ technology training is not statistically significant to 10th grade student outcomes. When controlling for all other variables, in Model XVI, math teachers’ technology training is not statistically significant to 12th grade student outcomes. These findings are supported in the literature.

Allen (2015) states that “teachers act as institutional agents and gatekeepers” and explains the importance of “investigat[ing] teachers’ ideologies of and practices with Black male students” (Allen, 2015, 78). If teachers are unwilling to integrate technological resources into their lessons appropriately, students may miss opportunities for deeper conceptual understanding.

Becker (2000) posits student outcomes are a reflection of how teachers use technological resources. This statement made earlier in the literature review highlights the importance of the proper implementation of education technology by teachers. The teacher must be trained and assessed regarding their ability to appropriately integrate instructional technology. According to Sang et al., (2010), despite instructional
technology mandates by educational policies, few teachers admit to properly integrating ICT into their teaching practices. Ertmer & Ottenbreit-Leftwich (2010) state that teacher technology training does not necessarily lead to effective use of technology in the classroom. Effective teaching comes from the appropriate use of technological resources for student facilitation. Livingstone (2012) posits that while ICT in education can enhance student learning, many teachers lack the ability to embed these resources into their curriculum. With lesser resources in Black schools, from facilities to teachers to technological resources (Horrigan, 2014; Coleman, 1966; McGee, 2009), teacher technology training is not a factor for student outcomes in this study.

While most schools offer teachers professional development for the integration of instructional technology, there is no system in place to monitor the proper use of these skills. The schools of Black males are absent the broadband speed and other resources necessary to support the technology mandate set by the Common Core State Standards Initiative (Horrigan, 2014; Coleman, 1966; McGee, 2009). Therefore, teacher technology training has a negative impact on student outcomes due to low teacher quality and poor facilities.

5.4 Standardized Test Scores and Student Perception of Math Ability

When controlling for all other variables, in Models IV and VIII, there is no statistically significant difference in 10th grade math scores for Black males with regard to their perception of math ability when nested with use of instructional technology as a focal domain. When controlling for all other variables, there is no statistically significant
difference in 12th grade math scores for Black males with regard to their perception of math ability when nested with use of instructional technology as a focal domain.

The findings for Black males with regard to their perception of math ability when nested with use of instructional technology as a focal domain contradict most of relevant literature, which highlight student self-concept and self-efficacy as important to Black male success in math. Most scholars have identified that student perception of math ability is directly associated with outcomes. Students’ attitude and behavior towards mathematics may be a product of their successes (Van de Grift, 2007). Weckbacher & Okomoto (2014) state that student self-perception of math ability is positively aligned with their performance. However, McGee (2009) states that Black students see themselves as proficient in mathematics despite lower academic performance and/or other beliefs that they are not. Coleman (1966) found that student-teacher relationships and self-perception of academic ability were salient predictors of success.

When controlling for all other variables, in Model XII, 10th grade math scores for Black males increase with greater perception of math ability when nested with teacher technology training as a focal domain. When controlling for all other variables, in Model XVI, 12th grade math scores for Black males increase with greater perception of math ability when nested with teacher technology training as a focal domain. These results support relevant literature.

As mentioned earlier, focus, motivation, engagement, grit and perseverance have shown positive correlations with high levels of academic performance and positive perceptions of math ability (Deberard et al., 2004; Wang, 2009). Wood (2014) found that
students with negative perceptions are less likely to ask for help, participate in classroom activities or engage in interaction with faculty members. With regard to mathematical learning, Ryan and Shim (2012) state that students that ask for help from teachers and classmates perform better than those who do not and have more positive self-perception of their academic abilities. Schenke et al., (2015) concluded that students that perceived more emotional support from classroom agents, asked for more help from teachers and peers and showed significant positive gains on math standardized tests.

The lack of statistical significance for student use of instructional technology, Models IV and VIII, is not supported by the literature. These findings are a consequence of having a low number of Black male student respondents which answered instructional technology questions for this survey. Models IV and VIII had N’s of 116 and 80 respectively. This limitation is addressed in detail in chapter 6.

5.5 Standardized Test Scores and Teacher/School Effects

When controlling for all other variables, there is no statistically significant difference in 10th grade math scores for Black males with regard to the teacher and school effects when nested with use of instructional technology as a focal domain. When controlling for all other variables, there is no statistically significant difference in 12th grade math scores for Black males with regard to the teacher and school effects when nested with use of instructional technology as a focal domain.

The results for teacher effects with use of instructional technology as a focal domain align with the scholarly research that follows. Ehrenberg et al., (1995), in a NELS study of student achievement when matching student to teachers’ race gender and
ethnicity, found no statistical significance for learning. Buddin & Zamarro (2009) longitudinal study in urban California schools concluded teachers’ content test scores and advanced degrees did not affect student outcomes.

Newton & Sandoval (2015) assert that suburban Black student performance is directly related to their level of socioeconomic status; the same is true for urban Black students as well. The study identifies that outcomes are driven less by location and more by SES.

When controlling for all other variables, 10th grade math scores for Black males decrease for public school respondents when nested with teacher technology training as a focal domain. When controlling for all other variables, 12th grade math scores for Black males decrease as total years of teaching increases. When controlling for all other variables, 12th grade math scores for Black males decrease for public school respondents when nested with teacher technology training as a focal domain.

Many of the findings associated with teacher and school effects when nested with teacher technology training align with scholarly literature. According to Coleman and Hoffer (1987), students that are sent to private and catholic school tend to have better student-teacher relationships, parental support, lower class sizes and greater scholastic outcomes than public school students. Private schools usually have better resources and parental support structures, which increase the value of education for Black students (Newton & Sandoval, 2015).

Harris & Sass (2010) found that teacher productivity increases with experience. They found that the first five years mark the greatest gains, while lesser continual gains
are made in remaining years of instruction. The study’s mention of a skewed distribution of instructional gains may account for the lack of statistical significance.

Black schools have high teacher attrition rates resulting in a less experienced teaching faculty; providing less-prepared instructors for the nation’s lowest performing population. In high poverty schools, teacher effectiveness and productivity is far less than other schools; the variation in teacher quality is greatest in high-need institutions (Sass et al., 2012). This variation in quality may be the reason for a lack of statistical significance with regard to teacher effects. In a study of teacher effects and productivity, Shuls & Trivitt (2015) found that highly effective teachers get better student outcomes.

McGee (2009) discusses the lack of male education professionals in Black schools; theorizing the value of male role Models for this marginalized population. While teacher gender is not statistically significant, the low population size may be attribute to this finding.

Clotfelter et al., (2007) longitudinal study of student achievement in North Carolina concluded that teachers’ content knowledge scores, grades and licensing ratings have larger positive effects for math educators. This study shows these effects to be present despite class-size or socioeconomic status.

5.6 Standardized Test Scores and Socioeconomic Status

When controlling for all other variables, 10th grade math scores for Black males increase with greater socioeconomic status when nested with use of instructional technology as a focal domain. When controlling for all other variables, 12th grade math
scores for Black males increase with socioeconomic status when nested with use of instructional technology as a focal domain.

When controlling for all other variables, 10th grade math scores for Black males increase with socioeconomic status when nested with teacher technology training as a focal domain. When controlling for all other variables, 12th grade math scores for Black males increase with greater socioeconomic status when nested with teacher technology training as a focal domain.

These findings align with previous research studies concerning socioeconomic status and academic achievement. As stated in the literature review, most minority and low-income youth do not have relevant knowledge and skills to compete with their moderate to high-income White counterparts (NCES, 2011). According to the National Research Council (2011) the Black/White achievement gap and high-poverty/low-poverty gaps are about one standard deviation away from each other. Sirin (2005) states that a positive correlation exists between student outcomes and socioeconomic status. Students from higher SES backgrounds usually outperform their lower socioeconomic status counterparts. Higher SES allows parents/guardians to prepare students for the school environment; providing a seamless transition from the home to the school. Low-income students are not afforded the same pre-school preparedness. “At least half of the well-documented achievement gap for low-income Black children is already present in kindergarten…” (Calzada, 2015, 1). According to Bourdieu (1977) low socioeconomic status is an indicator for a lack of academic success. Newton & Sandoval (2015) state that level of socioeconomic status is a powerful determinant of Black student success.
The findings of this dissertation support relevant literature regarding the fact that class trumps race. The possession of higher SES provides students greater educational opportunities and serves as the primary indicator of student success. More importantly, higher SES comes with a set of social and cultural norms that provide access to instructional and non-instructional resources. According to Crichlow (2014), many Black males experience the phenomenon of dominant groups with higher socioeconomic status “blaming the victim” for making use of non-dominant alternatives to compensate for their lack of opportunities. Using the sociocultural elements that are salient to this study, lower SES students can increase their agency to comparable social and cultural networks that allow for greater student outcomes. The idea is to avoid Black males having to resort to actions that allow “their masculinity [to be] weaponized and prisonized by powerful state actors and agencies of criminal justice, public policy and assorted moral entrepreneurs” (Crichlow, 2014, 1).

5.7 Theoretical Discussion

The Annie E. Casey Foundation (2014) found that less than 20% of 4th grade and 15% of 8th grade Black students read at grade level. The Common Core math curriculum requires students to read at or above grade level in order to solve word problems and properly provide explanations to mathematical processes. Schools with low-income Black students are among the nations lowest performing students. Mandara (2006) states that research has shown that Black males as a group are deficient at all levels of education. Interpretations of teacher effects in this dissertation have shown that the more experienced teachers of Black male students produce lower achievement levels. These are teachers situated in schools with substandard resources for high-need students.
According to Coleman (1966), Black schools have poorly equipped facilities, a high concentration of non-degree teachers and low student performance across all grade levels. McGee (2009) and Coleman (1988) state that Black schools have poorly maintained facilities, less experienced and/or uncertified teachers, and low student outcomes. The inequities in education for Black students remain present through the historical temporalities of change, identifying a need for social justice in education. Despite these longstanding inequities, there is a responsibility for parents, teachers and students to enact ways of being that allow participation and prosperity through education.

The ability to be successful in American schools requires an adaptation to the dominant culture’s ways of being. Bourdieu and Coleman describe this as possessing the forms of capital which allow for success (Bourdieu, 1977; Coleman, 1988). Many Black students come from communities where cultural and social norms differ greatly from that of the dominant White culture. Historical oppressive and exclusive forces catalyzed the formation of a sociocultural identity in Black communities that insulates and protects its members (Wacquant, 2012). While there exist different degrees to which this identity differs from that of the dominant culture, they possess a shared experience while characterized as the other. These identities provide community agency and access, yet depending on their ways of being may stand in opposition to the dominant culture. This situates many Black learners apart from many of their White counterparts; a group of students that misalign with the nation’s fundamental social actions and are denied access to opportunities in education, careers, health care, etc. (Wacquant, 2012).

As previously mentioned in the literature review, student perception of math ability is rooted in self-concept and self-efficacy. According to Weckbacher & Okamoto
(2014) math self-concept encompasses “knowledge and perceptions about oneself with respect to mathematics” and mathematics self-efficacy involves the “convictions about oneself with respect to mathematics performance” (Weckbacher & Okamoto, 2014, 59). Many students that possess identities that are counter to the dominant culture do not see themselves having the ability to be successful math learners. These individuals may have gone to school with personal math skills and ideas that did not align with that of their classroom. When the knowledge of their community and/or their family is not deemed relevant marginalized students become disengaged (McGee, 2009). In the United States, many students come from different cultural backgrounds and may experience the devaluation of their personal math knowledge.

Black Americans and their descendants have experienced highly-racialized oppressive forces with regard to pedagogy as involuntary minorities (Martin, 2012). Voluntary minorities came to the United States for opportunities and possess a value system that allows for a better transition to the dominant culture; these individuals wanted to be apart of this culture to gain access and agency for themselves and their children (Ogbu & Simons, 1998). Black Americans have struggled to create identities which allow for success through agency based on the prefaced exclusive and oppressive forces by the dominant White culture.

To effectively combat these inequities, Martin (2009; 2012) states that the use of culturally responsive pedagogies may allow access and agency for this marginalized group. The study of mathematics is rooted in White canonical culture and presents conceptual mathematical knowledge with a mono-cultural approach. Culturally responsive math pedagogy requires teachers to value the mathematical knowledge
possessed by students. The educator facilitates classroom discussion so that the agents understand the experiences and knowledge presented by their peers and helps students create positive synchrony between these forms of meaning making and the mathematical concept of study. Not only do students feel that their thoughts, ideas and perceptions with regard to math are relevant, they understand that their peers’ knowledge is just as important. This newfound respect allows students to strengthen their personal math identity and be responsive to the knowledge of others, including the dominant culture. While it is important that teachers work to engage students through the use of these culturally responsive pedagogies, policy must be aligned to support these changes (Martin, 2009; 2012).

Gutierrez’s sociopolitical mathematics presents a theory in which educational policy considers social justice for historically oppressed groups in curriculum development and access to educational resources. Students of marginalized groups have been denied equal access to educational opportunities; making them incapable of attaining agency for high-paying careers, property ownership and health care. The development of policy to account for these inequities will foster the use of culturally responsive pedagogies and bring social justice to future students. This equity-based theory is centered in the idea that power and identity are the most salient factors to student engagement and outcomes. This theory is relevant to this dissertation based on the need for social justice. Most math education research has only recently examined sociocultural theories that consider the effects of hegemony in society. These power issues have stayed within the boundaries of the social and cultural aspects of human practice when discussed by scholars. Gutierrez (2013) brings to light the political aspects
of education which privilege certain agents while depriving others. Here lies the need for critical mathematics to: provide learners an understanding of the political nature of society and their place within it as well as a drive to take action to expose and eliminate injustices.

According to Freire (1987), identity is formed through an understanding of the political framework of one’s society in relation to their own experiences and the identification of inequities on a global level. This concept, which Friere (1987) calls conscientizacao, situates learners as researchers that can analyze mathematics education critically and use mathematics to interpret data to influence policy. This highlights the need to conceptualize mathematics education as a bricolage of knowledge, power and identity (Gutierrez, 2013) and bring privilege to marginalized groups. With respect to this dissertation, sociopolitical mathematics theory explains how the implementation of instructional technology for 85% of American students only considers the needs of privileged groups. With a digital divide of technological resources (Horrigan, 2014) and the lack of highly qualified teachers (McGee, 2009; Coleman, 1988), proficiency in mathematics should not hinge upon the use of educational technology necessary for success on standards-based examinations. The use of instructional technology by underprivileged children demonstrates a lack of statistical significance, which can be explained in part by educational policy that stands against social justice in education.

This study highlights socioeconomic status as the strongest determinant of student success. Coleman (1966) explains that familial-level factors, parent’s income, education and occupation, are the greatest indicators for the academic success of their children. Class distinction brings with it many inherited ways of being that allow for social actions
that are aligned with that group. For many Black students, the intersectionality of race and class brings a devaluation of the attitudes, beliefs and behaviors passed down to them and/or encouraged by community associations (Gutierrez, 2008). Gutierrez & Dixon-Roman (2011) discuss the need for mathematics education that values the forms of knowledge possessed by students, calling on culturally responsive mathematics to increase student engagement and achievement. Martin (2012) states that culturally responsive pedagogies are essential to the feeling a part of the classroom and the curriculum for Black learners. Emdin (2012) states that there is an absence of cultural understanding and pedagogical methods required for teachers to create effective learning spaces for Black male students. Instead, these students become more and more disconnected to classroom practices and conceptual knowledge.

Coleman (1966) posits that the negative perceptions of academic ability comes from negative education experiences of parents past down to their children. Twenty-two years later, Coleman (1988) states that these inequities remain and makes a call for action to change education policy to account for these injustices. McGee (2009) states that while Black children are passed down negative perceptions of math ability, Asian and White parents pass down positive perceptions to their children. Parental involvement plays a huge role in student self-concept and self-efficacy. Castro et al (2015) performed a meta-analysis of parental involvement research from 2000 to 2013, which found that student achievement is highest when parents supervise student work, have high expectations and communicate student work and activities on a regular basis. When parents have positive synchrony with the school environment and their children, outcomes improve significantly. Parents that have endured highly-racialized experiences
in learning environments may not provide their children the positive support needed in order to build a strong perception of academic ability. According to Coleman (1988) this is a key social/cultural norm that leads to academic success despite socioeconomic status. In this dissertation, student perception of math ability is second to socioeconomic status and therefore is salient to student achievement for this population.

5.8 Summary

In order to properly investigate success in mathematics for 10th and 12th grade Black males across the use of technology to support teaching and learning, teacher technology training, student perceptions of mathematical ability and socioeconomic status were analyzed via OLS regression. In regard to outcomes for Black males, socioeconomic status and student perception of math ability showed a statistically significant positive relationship, while going to public school, teacher’s years of experience and use of instructional technology showed statistically significant negative relationship. This chapter has employed Bourdieu’s cultural and social capital, Coleman’s cultural capital and social action, Martin’s equity-based math education, Gutierrez’s socio-political mathematics and other relevant literature to explain the findings of this dissertation. These theories present an opportunity to understand the elements of socioeconomic status and student perception of math ability that contribute to student learning and their classroom environment.

High socioeconomic status individuals have been shown to possess inherited social and cultural norms which allow increased success in navigating through academic and non-academic fields. The effective negotiation of obstacles in learning environments translates to academic achievement, which situates these agents in higher socioeconomic
status institutions of higher learning, employment and spheres of sociocultural and political influence. The application of the sociocultural norms associated with high socioeconomic agents to individuals with lower socioeconomic classifications provides access to the aforementioned social spaces. These elements, applied for use with this marginalized group, would result in greater student outcomes and offer a better understanding of how they learn math with social and cultural capital.

Student perception of math ability is a positive predictor of student achievement, rooted in self-concept and self-efficacy. The social capital provided by teachers is pertinent to this factor, but the cultural and social capital from parents and guardians is the most important. Positive familial support was found to be significant to perception of academic ability and achievement (Castro et al, 2015).

For going to public school, teacher’s years of experience and use of instructional technology, research indicates that education for many Black male students is still separate, but unequal. Public schools, which serve Black students from low-income households, maintain poorer facilities, lower teacher quality and less technological resources. The gerrymandering of school district zones segregates learners from lower socioeconomic backgrounds in poor learning environments from their higher socioeconomic counterparts (Richards, 2014). The diversity of these schools have become an issue for social justice in education; rendering generations of students ill-prepared for institutions of higher learning and employment in the global market (Richards, 2014).

As predicted, instructional technology use and teacher training do not show significant gains in outcomes, due to the lack of school resources and poor teacher
quality. Coleman (1966; 1988) showed that the same inequities in education persisted after 22 years. Education technology presents many useful tools to support academics, but this research shows that it is the student’s social and cultural capital from home and school that impacts their desire to learn and the opportunities present to them.

For parents, passing on a value for education increases student perception of academic ability. For teachers, facilitating the development of learning environments that accept the many forms of knowledge students possess help students to enact agency. For students, striving for excellence in academic endeavors will bring success in education and potential for high-paying careers. More specifically, success for this unique population comes with the possession of social capital, cultural capital, perseverance, grit and determination. The chapter which follows discusses implications that examine these issues in greater detail.
Chapter 6: Conclusions

This chapter uses the knowledge created from this dissertation, outlined in the previous chapter, in order to identify generalizations for successful Black male student outcomes. These findings are used to examine implications for research; recommendations are outlined for students, parents, teachers and policymakers and/or politicians. The limitations of this dissertation serve to account for methodological restrictions. Lastly, suggestions for future research are discussed, as this dissertation is only the beginning of my contribution to the discourse of Black male success in mathematics.

6.1 Introduction

This dissertation is purposed to identify the elements of technology use in education that influence Black male student math achievement. Using the ELS: 2002, nationally representative survey, and SPSS 22, software for statistical analysis, four subgroups of Black male students were created. More specifically, the first two groups involved filtering for students that used technology in the math classroom during their 10th grade year and two years later in the 12th grade. The second pair of subgroups involved filtering for students whose math teachers trained for technology use during their 10th grade year and two years later in the 12th grade. To better account for student achievement, student perception of math ability, teacher/school effects and socioeconomic status were added as domain independent variables. To account for Black male student achievement this study used student respondents’ 10th and 12th grade standardized test scores. Bivariate and multivariate analyses were performed to analyze
data; based on relationships illustrated by T-tests, ANOVA and Pearson’s r this study used OLS regression to get a better understanding of how nested factors influenced Black male student outcomes. Relevant literature and the design of a theoretical framework were used to interpret results.

There is timeliness to this study that lends to the nation’s implementation of technology into teaching and learning as a Common Core Standards Initiative mandate. The Common Core outlines that study of math requires students to be proficient in many forms of technology for college readiness. With math as the gatekeeper to institutions of higher learning, technology implementation brings with it a host of challenges for teaching and learning; our nation’s lowest-performing groups will face the greatest of these trials.

This study was designed to better understand how Black male students learn with technology and other student/teacher/school/familial-level factors. The achievement gap, an inter-group comparison mechanism, used by researchers to document Black male achievement fails to provide solutions to this demographic; the dominant discourse provides an implicit message that understanding success for this population is unimportant. Using an intra-group methodology, a subgroup of students from this marginalized population was selected, as outlined above. This study is solely concerned with the factors that impact Black male math success in a White canonical education system. When baring in mind, that students from a non-dominant historically oppressed culture learn through and mostly from the agents of a dominant historically oppressive culture, it is apparent that the low-performance of these students may consequence a host of learning issues based on social, cultural and psychological barriers. A review of
literature relevant to the conduits and barriers to Black male success prompted the identification of salient domain variables and the selection of the independent variables therein. Scholars have identified student perception of math ability, teachers’ gender, race, education and years of teaching experience and socioeconomic status as important factors for student performance.

This dissertation has responded to call for research in Black male education studies. The contributions herein must be tempered, refined and applied to effectuate positive lasting change for this group.

6.2 Limitations

The use of the ELS: 2002 dataset provided this dissertation a nationally representative longitudinal survey, which followed American adolescents through their secondary and post-secondary lives. This survey required extensive government funding and well over a decade of data collection, analysis and interpretation. It is a privilege to work with a dataset like this, however, it brings with it certain temporal and structural limitations to this dissertation’s purpose that demand attention.

The ELS: 2002 is the fourth of five secondary school longitudinal surveys administered by the NCES. The base year surveys were administered in 2002 and follow-up surveys in 2004. The HSLS:09 was the latest iteration of the SLSP with a base year survey in 2009. Unfortunately, this survey did not contain any questions regarding instructional technology on its public use data files. The ELS: 2002, however, dedicated a significant group of technology questions on both student and math teacher surveys that made it the best choice for this dissertation. Therefore, a limitation to this dissertation is
use of a survey data gathered in 2002 and 2004. Applying interpretations of findings from students 13 years in the past require an understanding of the then, national system of math education, instructional technology, technology training and availability of technological resources, to those of the present. Students and teachers in 2002 and 2004 were adjusting to the No Child Left Behind Act written into law in 2001. This system used scientifically based research to form standards for educators to follow a guided instructional framework throughout the nation. The act required accountability in the form of state administered annual standardized exams for grades 3 and up using data analysis to determine future education policy and effectiveness of administrators. Today, most students in the United States fall under the Common Core State Standards Initiative, a system that mandates educators to provide students with standards-based learning that is assessed annually using standardized tests. One of the major differences in these two education reforms lies in the focus of accountability. NCLB held the school and school districts accountable for success, while the Common Core holds the teacher responsible for outcomes. During the NCLB reform, schools began to increase the amount and level of instructional technology used by teachers in response to increases in education technology on a global scale. Professional development for teacher use of technology also increased to support teaching and learning. The Common Core requires the productive use of forms of education technology in math classrooms to indicate aptitude. While these two reforms used technology, it is evident that, the level of technological resources and broadband speed today, offer greater opportunities for broadened learning experiences.
Many dynamic algebra and geometry learning programs like Mathematica and Geometer’s Sketchpad still exist today in newer iterations. In addition, the Texas Instruments graphing calculator is still in use with newer versions to support math learning. Regardless of these many similarities, the temporal and structural factors present limitations to this study.

Survey questionnaires are designed by and for investigators that are looking to answer a series of questions with regard to phenomena. The questions are carefully chosen, as are the response choices, to provide for an unbiased collection of data. The ELS: 2002 public-use dataset was used for its technology variables and its nationally representative sample of students. One of the limitations is that the ELS: 2002 made use of ordered response options for student and teacher respondents to collect evaluation data with respect to all technology and student perception of math ability variables. Among the many advantages to these types of questions are the increase in the speed respondents understand and answer questions, correct wording and vocabulary are used to create clearly distinguishable response options which can be changed to account for different types of respondents, and they allow for the production of uniform answers. However, these ordered response questions limit the study in that: respondents’ interpretation of these questions may vary and ordinal data has very few options for statistical testing. For example, question 31 of the student base year survey asks:

In your current or most recent mathematics class, how often do/did you use computers in the following ways?
   a. Review work from the previous day
   b. Do word problems or problem solving activities
   c. For graphing
   d. To practice math drills
   e. To analyze data
f. To apply what was learned in class to new situations or problems

g. The teacher uses/used the computer to instruct us individually

h. The teacher uses/used the computer to demonstrate new topics in mathematics

(MARK ONE RESPONSE ON EACH LINE)

Never

Rarely

Less than once a week

Once or twice a week

Every day or almost every day

Respondents may have different views regarding computer use. If an interactive whiteboard is used daily to teach, student respondents may have checked off “every day or almost every day”. Yet a whiteboard can be used an interactive tool with Internet resources or just as a display that is comparable to a blackboard. While these questions were balanced and included options from the negative end of the spectrum to the positive, their answers may have been affected by respondents’ differences in aligning subjective qualitative options to quantified actions in teaching and learning.

This dissertation was also limited by the non-specific identification of forms of technology. The survey questions ask what teachers and students used technology for, but did not provide specific examples of technology used in classrooms. During the time the ELS: 2002 was administered, instructional technology could be the possession of one computer in a room used sparingly to computer labs with the highest Internet access speeds and best resources available. The facilities survey of 2002 only mentioned student ability to access computers in classrooms and other areas in the school, but does not provide a parochial scope of which to understand the differences in learning environments when measuring achievement in students with historical inequities in education.
This dissertation’s use of the word “Black” was used to identify individuals whose ancestors were part of the African diaspora. This study did not account for voluntary and involuntary minorities, the number of generations in the United States and whether you immigrated from Canada, Latin America, South America, Africa, Australia, Europe or Asia. Each distinct group of immigrants and non-immigrants has a different set of racialized education experiences, which contribute to their academic success. Despite being a descendant of African slaves, Colin Powell, the son of immigrants from Jamaica explains his experience as a voluntary minority whose parents came to the United States for a better life for their family. Meanwhile, President Barack H. Obama was born in Hawaii, moved to Indonesia in adolescent years and then returned to the United States. He was raised by his mother who was White and for a time lived with his White grandparents. While these two distinctive figures had very different experiences, they shaped their identities and worldviews based on the influences to their ways of being. Individuals born in the United States whose descendants were once slaves in this country share ontology of race that misaligns social, cultural and psychological norms from that of the voluntary minorities and the dominant White culture. The examination of data aggregated to reflect the classification noted above would have provided deeper incite into the nuances and contradictions with respect to outcomes for this unique population.

While the ELS: 2002 maintains a sample of over 15,000 students, only 1004 students are Black males. After using the focal domain subgroups (use of instructional technology in the math classroom and math teacher technology training, to represent instructional technology) this group of 1004 was filtered as described earlier to create
four subgroups for regression analyses. These pragmatic considerations led to the sample size being less than desired. The filtering process left 116 10th grade respondents that use instructional technology in the math classroom, 80 12th grade respondents that use instructional technology in the math classroom, 431 10th grade respondents whose math teachers train for technology use and 323 12th grade respondents whose math teachers train for technology use. This small sample size may have negatively impact the results of this study and represent a limitation. The larger the sample size, the more confidence one has in their findings. It increases the level of precision in the results allowing proper theoretical interpretations and application to practice.

As mentioned earlier, 10th and 12th grade math standardized examinations were used to classify the level of student achievement for this dissertation. While standardized tests are the gatekeeper to institutions of higher learning and provide access to other educational opportunities they may not be the best indication of academic prowess for Black male students. Standardized tests are used to provide information about how students test with regard to others across grade levels. They provide the federal government evidence to compare groups and perpetuate the achievement gap. These baseline analyses offer no consideration for sociocultural factors, ability of teachers or rigor of the standards. The use of standardized test is a limitation that may have given a distorted picture of success in math for this marginalized group.

Lastly, technology use in the classroom is more familiar to students that possess these resources in the home. Access to technological resources, educational or for personal use, represent pre-existing knowledge that allows for a seamless transition from
home to school. This dissertation did not consider differences in outcomes for students that possess these resources and those that do not.

6.3 Implications

This dissertation presented many factors which contribute to the math success of Black males in secondary school. Of these factors, student perception of math ability and socioeconomic status showed a significant positive relationship to outcomes, while use of instructional technology, total years of teaching math and being a public school student predict a significant negative relationship to achievement.

The crisis in education for Black males represents a failure in the American education system to provide these students equal access to the facilities, highly qualified teachers and instructional resources. To combat these educational inequities, students, parents, teachers and policymakers must consider ways to effectuate positive lasting change in Black male student achievement. While each of these constituencies have a similar agenda, they each play a different role in the education of Black male students. Implications for each will be addressed below.

Students

Many Black male students inherit racialized forms of experience from their parents. These experiences influence their ontological foundations with respect to society, while their personal experiences shape them. The sociocultural framework of the school may stand in opposition to many of the beliefs held by these students. While the transculturation of Black Americans has been one of survival, there is a need for a paradigm shift to progress and prosperity. To enact this change students must possess a
strong connection with dominant forms of knowledge prior to attending schools. Black learners need a positive value for education, respect for school authority as parental authority, pre-schooling, and positive ethnic/cultural awareness. Implicit in this worldview is the understanding that success in education leads to financial prosperity and a better way of life in America.

Learning hinges on student-teacher relationships; positive synchrony between teachers and students creates connections that allow for learning and agency. It also requires the use of educational resources for individual and group learning platforms. Technology offers a means to level the playing field. Students must look past what the teacher can provide and see the Internet as a mechanism for change, in that it maintains a wealth of knowledge that can supplement and advance the learning of students. The Internet should also be used for exposure to different employment opportunities, so that students are exposed to careers at an early age. Thinking about careers stimulates interests in: varying subject content knowledge, SAT/ACT preparation, institutions of higher learning, salaries, travel, etc. Career goals contribute to student’s focus, motivation and work ethic.

Parents

Parents are the most important agent in a child’s learning, because they set up the pathway to forming identity and are usually a child’s first teachers. They have the unique responsibility to pass on to their children a set of survival skills to protect them from harm. Many Black Americans have perpetuated a negative view of the American education system based on experiences involving race, culture and class. Black parents
may choose to share with their children threatening and opposing forces in order to protect them from that which they and/or others have endured. While it may be appropriate way to prepare children of an oppressed people for American life, negative experiences should be accompanied with positive messages that give hope and drive to Black children. Additionally, more positive experiences should be shared to encourage a value for education. This dissertation offers evidence of the statistical significance of student perception of math ability. Research indicates that parental involvement is a major determinant of student academic identity (Martin, 2012). Black learners need confidence, grit, perseverance and support to negotiate the American education system. Regardless of the inequities that exist, these students require a value for education and a drive to academic prowess. While parental involvement is not a domain for this study, research shows that support from parents increases student perception of academic ability and achievement.

For all learners, success in education is a springboard to higher paying jobs and a greater standard of living. As an oppressed people, handing over the responsibility of educating one’s children solely to an oppressive culture is counterproductive to success. When considering that opportunities for the future hang in the balance, Black parents have to be heavily involved in their child’s education. Research evidences the savage inequalities that Black students face. This requires that parents contribute to their child’s learning to ensure that they are prepared for all assignments, assessments and sociocultural eventualities.

Technology is the fabric of our lives and technology skills represent global currency. Parents should look to providing computer technology access for their children
in the home or non-school environment. Prior knowledge to recognize, understand and use these resources at home has been shown to increase student engagement. Internet resources provide seemingly limitless educational opportunities to facilitate the instruction of most learners. Youtube.com and Khanacademy.com are just two of many sites that offer countless lessons in math and other disciplines, so that students can construct knowledge in-and-out of the classroom. Parents must invest in their child’s education with technological tools to ensure their children opportunities to further their knowledge and connect their ways of being with these devices and others using them.

**Teachers**

Teachers have the ability to effectively and efficiently facilitate knowledge making for their students when they are given proper training. Implications for the teaching practice involve improved interactions between the agents in the classroom, specifically student-to-teacher and student-to-student. The belief in one’s ability to understand, explain and complete math tasks and assignments stems from past experiences in classrooms and influences from others with experience. For Black males, these experiences are highly-racialized, where success depends on grit, perseverance and resilience. When teachers and students can exist in learning spaces with positive synchronous relationships, learning outcomes improve. Traditionally, the math classroom’s teacher imparts mandated instruction to students. Students in this traditional framework who become active participants facilitate instruction by moving content from presentation to understanding to application; this field thrives when the social actions of its agents are aligned and positive. Prior research and this dissertation show that student perception of math ability is a significant factor in student achievement second only to
socioeconomic status. In lieu of socioeconomic factors, culturally responsive teaching practices produce learning environments that provide all students with respect for related cultural knowledge and experiences. The teaching and learning of mathematics should involve educators understanding the importance of being able to use all forms of knowledge for instruction. This task is a difficult one for teachers, schools and students. Each agent has to commit to developing these spaces and be trained to understand how to shift between types of knowledge with respect. In an interview of teachers of Black male secondary students, Allen (2015) states that teachers reported a gap between students’ culture and that of the school. They also reported the assignment of labels and stereotypes to students by their colleagues. These forces disallow agency in schools and are a root cause of negative perceptions of academic ability for this group of students. Vandergrift (2007) and Houts & Morrison (2008) posit that cultural relationships between these agents are important to teaching and learning. Teachers that can facilitate social interactions that provide access to all in teaching and learning can create fields of inquiry that effectuate positive change in student academic self-concept and self-efficacy.

**Policymakers**

In an exploration of digital technology use in classrooms, Thomas and Palmer (2014) suggest that pedagogical technology knowledge is needed in these arenas. Many teachers that have been teaching for many years are resistant to change. With mandates to use technology, Thomas and Palmer (2014) state that teachers are unwilling to implement technology despite its characterization as being essential for math proficiency. The professional development required for active teachers to become proficient in new
iterations of education technology and the ever-changing landscape of instructional guidelines and initiatives have made many education professionals resistant to change.

This research highlights the possession of strong math self-concept and math self-efficacy as a robust predictor of Black male success in mathematics with instructional technology. School administrators should provide professional development for their teachers geared to promoting a positive math identity for their Black males students. Teachers facilitate student-led discourse on important issues that are of concern and provide a safe space to share experiences. Over the past five years, many schools have employed social emotional learning programs to address issues of identity, both academic and social. These initiatives use the same fundamental framework as culturally responsive pedagogies and promote social justice in education.

Tokmak (2014) explains an intervention using Technological Pedagogical Content Knowledge (TPACK), a pre-service instructional program prepares new teachers to bridge the gap between content knowledge, pedagogical practices, and technology use to support and enhance teaching and learning. The use of this pre-service initiative has produced teachers that are more comfortable implementing technology (Archambault & Crippen, 2009).

Another intervention used was the development of a methods course to provide training in culturally responsive mathematics education by Tawfeeq and Yu (2012). Tawfeeq and Yu (2012) employed the use of cogenerative dialogue to document and interpret teachers’ perspectives on race, culture, and mathematics education. This pre-service initiative allowed teachers to engage students from different backgrounds to
provide a host of cross-cultural experiences for teachers to consider how they see students and themselves as pedagogues. This class consisted of White teachers interacting with minority students that shared their racialized experiences in school. The study showed that White pre-service teachers highlighted SES and not race or culture as responsible for their low achievement. This pre-service class attempted to introduce culturally responsive practices that would lessen the gap between the beliefs teachers and students share regarding the sociocultural framework of the class and student outcomes. Throughout the class, Tawfeeq steered the class into issues of social justice in education, which allowed many pre-service teachers to appreciate the experiences of the students and reflect on responsive pedagogical approaches.

For teacher success, cultural responsive pedagogy, content knowledge and technology should presuppose one another in the classroom producing a seamless creation of knowledge. The interventions above highlight the need for teachers to account for cultural differences, integration of and training in technology and conceptual knowledge in classrooms to produce academic gains for Black learners.

Mobile instructional technology has grown past laptops and tablets to the use of student cellphones in classrooms. The ubiquity of personal mobile devices has spawned the development and implementation of software apps that allow for students to engage in real-time activities. Current research has shown that when used properly, mobile cellphones can be used as instructional technology that can engage, network and track students and their work (Castek & Beach, 2013). Musti-Rao, et al. (2015) state that when cellphones were used for math fact fluency for computations of algebraic concepts, students have shown a statistically significant increase in their math outcomes and
process. Many students possess microcomputers, yet they serve as glorified word processors or a media entertainment device. The use of cellphones in classrooms represents an opportunity to use a device that many students already have familiarity and comfortability. While many students do not possess microcomputers many of them have cellphones as their primary computing device. The implementation of cellphone usage into the math curriculum has shown mixed reviews. One of the largest issues is one of equity. Cellphones have been seen as a distractor in classrooms across the nation and until recently policymakers have set mandates to prohibit their use in educational settings. For students in higher socioeconomic schools, cellphones have been transitioning from distractive influence to beneficial technology. Lower socioeconomic schools, especially those with predominately Black populations continue to prohibit cellphone usage or presence due to the security issues they present; the existence of these high value items in poorer schools allow for more device related crimes. This highlights a need for policymakers to find ways to provide secure spaces for students and provide adequate access to make use of this growing mobile technology initiative.

In Cincinnati, Ohio Accelerate Great Schools have decided to test-run the Indianapolis-based Phalen Leadership Academy’s blended learning framework. This initiative was designed by Mark Phalen to provide lower income students with technology-based education. Five schools were developed with a $1 million startup and while ambitious goals have been set, the students are meeting expectations. Based on the success of this model, Cincinnati Public Schools are confident that with proper implementation their schools can transition to high-technology blended community.
Past Student-Centered Learning Initiatives

There is a need for math education to return to this student-centered learning approach that considers student knowledge as valuable to teaching and learning. Policymakers have a responsibility to implement new ways to mandate pre-service and provide incentives for in-service teachers to train in and integrate culturally responsive approaches. The development of policy should require well-documented, un-biased research of which to evidence the potential of proposed initiatives for positive change.

C. Alan Riedesel

During the 1960’s, many developmental/behavioral psychologists’ conducted research that would later influence how pedagogues could provide better instruction. In order to communicate the language of mathematics effectively, researchers believed that it was important to better understand how the mind of a child works. Research looked to behavioral approaches through rote memorization and repetitive exercises to meaning making through part-whole relationships and the evolution of comprehension by building on previously learned knowledge (Rappaport, 1966). Students were given activities that allowed for understanding through pattern structure recognition leading to a discovery concept. This discovery concept presented a type of situated learning where teachers were very important in creating dialogue that would foster learning and growth. This now presented a new problem; the need for better teacher education in the United States (Riedesel, 1967). Teachers would have to understand how to recognize knowledge construction and ask the right questions to further understanding. Basically, educators would have to break the mold of a student as strictly a learner. Then an environment was
created where the responsibilities of teaching and learning were given to all; everyone
was made an agent of change. C. Alan Riedesel was an advocate for change in
elementary school mathematics in the late 1960’s to early 1970’s that posited discovery
learning required better teacher education. To properly facilitate learning, teachers had to
understand how to bring together the classroom environment that possessed many
different ideas so that knowledge making occurred by using questioning to bolster peer-
to-peer instruction. Students used verbal explanations or visual representations through
graphing diagrams to assist their learning as well as their peers (Riedesel, 1967).

**Piaget & Bruner**

The influence of Piaget and Bruner impacted education policy research in
attempts to focus on more child centered inquiry. Jean Piaget’s genetic epistemology
served to examine the origins of knowledge making. His studies explained that
knowledge happened in its truest form through one’s direct interactions with the world
and that experiences allowed individuals to continuously reconstruct knowledge. As far
as education was concerned the focus had been assimilation and accommodation, human
perception of information and the self-interpretation of new structures, schema and
conceptual information (Block, 1982). Learning/meaning making comes from a
dialectical relationship between the functions of assimilation and accommodation. As
learners grow the equilibration of the two concepts bring better understandings. Jerome
Bruner’s theories of cognitive learning offered a vision of curricula that required students
to look at different sides of a situation and draw hypotheses. The ability to develop
conjectures and to think through them with the help of guided instruction mirrored the
same kind of discovery learning as prefaced. Education research through the 1960’s had
looked to understand the minds of human beings. Bruner’s Man: A Course of Study endeavored to examine the essence of being human and developing knowledge. This vision allowed research in mathematics education to re-examine rote memorization and math for discipline initiatives of the past. By allowing students to make their own conjectures and develop conclusions through carefully guided instruction learning becomes a self-motivated undertaking through the lasting power of a lived experience (Bruner, 1966).

*John Dewey*

John Dewey was able to make his own waves in education reform through the establishment of the laboratory school at the University of Chicago. With his own institution, Dewey was able to put his pedagogical theories into practice. He saw that reformers of education produced curricula that, and teachers who, wanted students to solely attend lectures/lessons, memorize facts and participate in repetitive drills in a non-student centered environment (Dewey, 1900). The acquisition of knowledge was an individual affair in which facts and the truths were absorbed and assessment was measured only by what was retained. Dewey believed that this was a selfish process with no social gain. In society, people work together “along common lines, in a common spirit, and with reference to common aims” (Dewey, 1902). This requires a continuous exchange of thoughts and ideas. Specific to mathematics education, Dewey saw the subject matter was taught through recondite drilling of arithmetic skills. “The present educational systems, so far as they destroy or neglect this unity, render it difficult or impossible to get any genuine, regular moral meanings” (Dewey, 1897). Children live in a world of tangibles where their senses help them to make meaning of the world.
According to Dewey, schools must discontinue requiring students to shift their thought processes to abstract concepts. If students gain knowledge from what they know, learning becomes a comfortable, easy and natural process (Dewey, 1902).

The use of abstractions in mathematics education was unnecessary when society possessed so many concrete references to make meaning of mathematics. Teachers can ask students about common activities that are part of their lived experience and make connections. If a child can relate an event or process that they are familiar with and make meaning through cooperative and collaborative discourse with those in the class through carefully teacher ushered questioning, the student has power over their own learning. Furthermore, the student becomes a social individual that has the ability to make meaning with others (Dewey, 1900). Dewey’s ideas started the Progressive Education Movement that lasted up until the Second World War. Through the adoption of his educational perspective, teacher education sought to prepare practitioners to allow students to build on prior knowledge; promoting student learning from relating a new situation to a previous experience. Educators would rely on hands-on-learning, problem solving with critical thinking, group work activities, cooperative learning projects and a host of other qualities that were mixed and matched to represent the different schools of thought of progressive education (Soder, 1996; Kilpatrick, 1992). Despite their differences, progressivism carries the belief that the school should reflect society where its members actively participate in the social, economic and political realms. Schools are meant to teach children how to live in and be part of a democracy. Vocational studies prepare students for real life and can be used for them to be constructive and empowered (Dewey, 1897).
Dewey had a utilitarian view of mathematics; believing that students should be taught math based on its “direct practical value”, or if they personally wanted to learn math. The result was a thematic, child centered teacher guided lesson that required less focus on subject matter, but more time asking questions and building knowledge from themes. Although many policymakers and elementary/middle school practitioners endorsed this viewpoint, the high school level was very resistant. Since secondary school math teachers were highly trained with a specific skill set, they were unwilling to abandon their subject area to accommodate an interdisciplinary student-centered approach (Kilpatrick, 1992).

Dewey’s approach to mathematics education is essential to elementary and middle school education. Students are exposed to math concepts which manifest themselves in the real world and through teacher and peer facilitation, they can make meaning. This approach regards all forms of knowledge as relevant regardless of culture. The progressive style maintains a curriculum that is flexible, in that, the teacher can find ways to interpret and include forms of knowledge to a particular situation and spend time guiding connections for students. With exception to the progressive movement, there has been no real connection between education and culture. The United States is a very diverse nation whose education system accounts for many different types of learners from very distinct cultures. The United States has yet to successfully introduce a working curriculum that links culture and education. This is not proposing ethnomathematics, even though having a dialectical relationship between the two functions seems feasible. Rather that policymakers look to re-establishment of a more progressive approach to
curriculum development focused on how students create, understand and use mathematical knowledge.

**NCES Technology Survey**

In light of the Common Core Standards settings technology mandate, the executive branch could provide directives for the NCES to create a questionnaire section in the sixth Secondary Longitudinal Survey Program dedicated specifically to technological resources used by teachers and students to support learning. This will provide a nationally representative sample of student and teacher respondent data to better understand how students learn with technology. As technology continues to evolve it is important to collect relevant data that is timely, so that salient findings can be interpreted and put to practice in pre-service education, professional development programs and classrooms. In addition, this survey should ask both students and teachers to identify the specific forms of technology used in the classroom. This offers an examination of Black male outcomes based on the integration of specific technologies.

**Big Data and Learning Analytics & Mathematical Tasking**

New technology initiatives require support and accountability to influence policy. Picciano (2014) examines how instructional applications, big data, and learning analytics influence the data-driven decision making (DDDM) of administrators in higher education with respect to blended learning environments. Kaufman and colleagues define data-driven decision making (DDDM) as “the use of data analysis to inform choices involving policies and procedures” (Kaufman et al., 2014, 579). DDDM has been used mainly for accountability in the collection and analysis of high-stakes standardized testing data. The
authors (Kaufman et al., 2014) point out that while information on testing influences state and federal policy, there is likewise information important for the classroom decision-making of educators and in-school administrators. Researchers have called for DDDM models that take into account the needs of all education professionals and students to support measurement and evaluation in teaching and learning. Administrators in higher education should continuously revamp their educational organization to reflect the ever-changing demands of the global economy’s need for human capital. To best serve their student academic population, data-driven decision making (DDDM) can be used by administrators to manage academic planning, policy and budgeting (Picciano, 2014).

Picciano (2014) defines big data as the use of one or more database systems to store subject/respondent transactional, longitudinal data in large quantities. Each transaction is taken in real time and analytics software is used to examine the data and present conclusions for administrative use. Learning analytics provide indicators of achievement for students, faculty and administrators to monitor and endeavor to understand elements of teaching and learning.

According to Picciano (2014) more than one-third of higher education students took fully online courses in 2013. This presents an opportunity to use big data and learning analytics to support online instruction. These tools, because they can collect each datum in real time, prove to be useful support resources. The difficulty in using learning analytics for blended learning environments stems from the ways in which fields are constructed; traditional face-to-face interactions offer no reasonable opportunity for real-time recording and analysis of large quantities of performance data, which according to Picciano, may cause significant learning gaps. Additional concerns are the abuse of
data, lack of administrators who are experienced in this technology, and use of this data by the federal government to influence policy.

While Picciano focuses on institutions of higher learning, all institutions that use online learning methods could benefit from his research on technology-based approaches to record and analyze salient student data. His findings may be applicable to the set of powerful technological tools that can be used to evaluate online instruction in secondary schools. This dissertation interpreted ELS: 2002 survey data to understand the impact of technology on the success of Black males in secondary school mathematics. Through the use of big data and learning analytics to monitor and analyze student transactions, researchers may arrive at a better understanding of how the student population learns mathematics. Researchers, software designers, administrators, and other groups that influence policy can use these tools to develop culturally responsive mathematics that is tailored to the learning style of each student.

Maher and colleagues explored performance of mathematical tasks and the cognitive development of children through the use of interviews designed by Piaget (1965, 1975). Researchers in mathematics education use his methods to understand how students create meaning and interpret critical thinking tasks. These tasks are “intended to elicit in subjects estimates of their existing knowledge, growth in knowledge, and also their representations of particular mathematical ideas, structures, and ways of reasoning” (Maher, 2014, p. 579). Because each student provides evidence of strengths, needs and deficiencies that can be used to format classroom lessons with differentiated models that are aligned with online learning resources student reasoning and knowledge construction are important to educators and software developers to create fields of inquiry that bridge
the gap between traditional face-to-face and online learning (Maher, 2014). To accomplish the tasks ethnographers use detailed protocols, consider task design, pay attention to reliability and generalizability, and rely on audiovisual devices for further analysis. Some tasks are open-ended and require structures that allow for flexibility and judgment.

Coupled with big data and learning analytics, task-based interviews may offer opportunities for mixed methods research to provide a clearer picture of complex learning issues. These technological approaches can realistically function only with electronically gathered data. Therefore, task-based interviews link large quantities of data interpretation to traditional face-to-face learning. Blended learning environments can evolve to meet student needs through this synchronous relationship. This bricolage would be dynamic as qualitative and quantitative domains complement each other.

6.4 Future Research

This dissertation highlights socioeconomic status as the main contributing factor to student outcomes. The acquisition of social and cultural capital leads to agency in networks that may provide potential for economic capital in the future. Parents of high SES students pass these resources down to their children ensuring continued access institutions of higher learning and higher-paying careers.

A pragmatic solution to helping students with low SES produce greater gains in math, is to identify the social and cultural aspects of high SES individuals that would provide low SES students similar education opportunities. Using the High School Longitudinal Study of 2009 (HSLS: 09) student base-year and follow-up surveys, an
examination of high SES Black male students may provide incite as to the factors which account for success for this population. I hypothesize that a specific set of factors exist which contribute to academic success that can be gained from the nation’s highest performing Black male students.

A qualitative examination of Black schools that have achieved success in implementing technology in math classrooms may offer significant findings with regard to how Black male students learn with technology. Berry (2015) states that too much attention is spent researching the failures of Black students instead of their successes. This study should consist of interviews of administrators, teachers and students regarding their experiences and attitudes toward technology use and training.

The High School Longitudinal Study of 2009 student base-year and follow-up surveys has a section dedicated to the learning experiences of students with regard to mathematics. This survey presents an opportunity to explore the social, cultural and psychological factors which contribute to the teaching and learning of mathematics for this population.

For this dissertation the word Black refers to descendants of the victims of the African Diaspora. To account for the many ethnicities of Blacks and their generational status, a study of Black males could be more informative as to how these students learn. It is important to understand how different ethnicities of Black males learn mathematics against the backdrop of racialized forms of experience in the American education system.

Black males are not a monolith; representing differences in class, ethnicity, sexuality, region and academic success. Edmin (2012) developed tools to help teachers
and students better understand the experiences of different Black males. The use of
cogenerative dialogues, coteaching (student-led), cosmopolitanism, context and content
are described as the five tools to build success for this population. It is important for
policymakers to reconsider identifying Black males as a group, but as separate
individuals with different learning styles and ways of being. It is imperative that future
research looks to the diversity of Black males with regard to ethnicity, class, sexuality
and region. The intersectionality of the prefaced classifications may offer insight into
how different types of Black students learn.

While the use of instructional technology is a mark of proficiency in mathematics,
it is important to investigate how students are using these resources across individual-
and performance-levels. Students from the highest socioeconomic backgrounds are
exposed to many trending education technologies, such as:

1. flipped learning
2. device agnostic learning
3. assistive technologies
4. mobile learning
5. blended learning

These learning platforms are all supported by the highest broadband speeds and highly
trained pedagogues. More importantly, economic capital provides sustainability to
acquire and train teachers for newer iterations of technology and policy mandated
education technology initiatives. Conversely, students from the lowest socioeconomic
backgrounds are less likely to be exposed to the aforementioned instructional
technologies. This marginalized group boasts less-qualified teachers and ill-equipped
school facilities that provide minimal educational resources (McGee & Pearman, 2015).
While many Black schools have microcomputers, interactive whiteboards,
scientific/graphing calculators, Ipads and other forms of technology, they are often outdated, improperly incorporated into curriculum and lacking the broadband speed necessary for time appropriate implementation (Horrigan, 2014). It is important that future research consider outcomes for different types of Black males as well as the prefaced inequities in education for this unique population. Based on previously discussed literature, I hypothesize that a qualitative study designed to examine the math outcomes with technology for the top 10%, bottom 10% and the remaining 80% of Black male students will show statistically significant differences. It is my opinion that the deficit-filled discourse requires additional research. I would like to design a study using task based interviews, cogenerative dialogues of 5-7 students and a coteaching element.

Research has shown that many of the problems of low-performing, Black male students are due to the discontinuities in the culture of their non-school and school environments. In response to these challenges, I would like to conduct an ethnographic study that would examine the racialized forms of experience of a nationally representative sample of Black males. Specifically, how these students view their educators through the lens of cultural discontinuity. The idea is to understand how cultural differences affect the teaching and learning of mathematics for Black learners. The cultures of the home/community associations are the primary environments for knowledge production. I hypothesize, that those Black male students that have been prepared for the culture of the school environment will perform better than those that have not been prepared. Preparation, as mentioned earlier, is defined as having a positive value for education, respect for school authority as parental authority, pre-schooling, and positive ethnic/cultural awareness. To identify preparedness, student respondents will
take a survey that will gauge this factor. These students will also participate in individual interviews, classroom observations with audio/visual recording to examine body language, facial expressions accompanied by prosodic analysis to discover connections between emotion, body language, and speech. This includes positive and negative synchrony between all the agents in the classroom.

Preparedness is the most salient factor in this study because in my opinion all children experience an initial discontinuity between their home/community and school. This is in how they learn contextually, how they make use of language, how they are disciplined, how they are rewarded and how they live. In my opinion, those that show through the survey and interview process that they were raised with the tenets of preparedness previously mentioned with synchrony to the school will be better learners.

While the demands of the average secondary school teacher are great, there is a need for continued professional development to stay current with the changes in standards and technology. By offering paid professional development for in-service educators, afterschool and weekends, teachers may be more motivated to grow their instructive approaches. American teachers have the responsibility to prepare our nation’s human capital for the global economy, but are absent the financial compensation to grow their craft. In a capitalist nation, it is foolish to think that teachers will neglect their own personal responsibilities to train to meet the needs of their students in an ever-changing landscape of educational policy, standards and technology. I would like to study how monetary compensation in the form of grants, stipends and overtime pay will allow teachers opportunities to improve their ability to teach at or above the levels of
instruction mandated by education standards. I hypothesize that teacher commitment and motivation to grow one’s craft is greatly affected by monetary compensation.
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