LONGITUDINAL STUDY ON THE RELATIONSHIP BETWEEN AFRICAN AMERICAN BOYS' ATTITUDES OF THEIR TEACHER-STUDENT RELATIONSHIPS AND THEIR MATHEMATICS ACHIEVEMENT ON STATE TESTS

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by

Corina K. Bullock

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DEDICATION

To my Lord and Savior, Jesus Christ, I dedicate this dissertation. There were so many days I struggled to connect my ideas and to capture the words that portrayed the very essence of my thoughts, but through prayer, you being God with your infinite grace and mercy guided me along the way. If not for your love and your many blessings you bestowed upon me, this work would have been impossible.

To my loving and favorite husband, Pastor Kevin L. Bullock, Sr. I dedicate this dissertation. You are my soulmate and my friend. No matter the numerous adventures I have embarked upon throughout our marriage, it has been you who has been the wind beneath my wings. Whether you were in the fore-front or the background, you were there without fail providing me both emotional and monetary support as I pursued my bachelor of science, master of education, and doctoral degrees. For that, I am grateful to you and blessed to have you as my better half.

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ABSTRACT

Bullock, Corina K., *Longitudinal study on the relationship between African American boys' attitudes of their teacher-student relationships and their mathematics achievement on state tests*. Doctor of Education(Educational Leadership), August, 2018, Sam Houston State University, Huntsville, Texas.

Purpose

The purpose of the present 2-year longitudinal retrospective investigation was to determine whether there was a relationship between fourth- and fifth-grade African American boys' attitudes of teacher-student relationships and their mathematics achievement. Data from the Measuring Effective Teachers (MET) project conducted from 2009-2010 through 2010-2011 school years and sponsored by the Bill and Melinda Gates Foundation (2013a) were utilized in this study. The participants were 2,468 Grade 4 African American boys and 2,739 Grade 5 African American boys enrolled in five large, urban school districts across the United States. Archived data comprised the individual responses of the participants from the Tripod 7C's survey and the mathematics scores from state tests (Bill and Melinda Gates Foundation, 2013a).

Method

In addressing the research questions, the statistical method utilized was multiple regression. The independent continuous variables came from the 7Cs survey and comprised care, control, clarify, challenge, captivate, confer, and consolidate. The dependent variable in this study was the mathematics state test scores. Several assumptions for multiple regression models were met prior to being appropriately applied to the population of interest in that the coefficients and parameters of the regression equation were not influenced by one another.

Findings

The results of this study were similar to findings of recent literature with respect to the relationship between African American boys' perceptions of their teacher-student relationships and their mathematics achievement on state tests. Additionally, the results of this study added to the present body of knowledge by examining teacher qualities that African American boys perceive as impacting their mathematics achievement. From the results of this study with Grades 4 and 5 African American boys, positive relationships existed involving control and clarity with mathematics scores, while there was a negative relationship between consolidate and mathematics scores.

KEY WORDS: African American boys, Clarity, Mathematics, Mathematical literacy, Non-verbal immediacy, Social emotional learning, Teacher behaviors, Verbal immediacy

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CHAPTER I

Introduction

Statement of the Problem

Education is the key to securing economic success, acquiring a higher quality of life, and competing for jobs in this present global society (Darling-Hammond, 2006; Douglas-Hall & Chau, 2007; National Council of Teachers of Mathematics [NCTM], 2011; Valverde & Näslund-Hadley, 2010). Accomplishments in the workplace are greatly enhanced when individuals know and are able to apply mathematics concepts or mathematical literacy (Kilpatrick, Swafford, Findell, & National Research Council [NCR], 2001; Organization for Economic Co-operation and Development [OECD], 2010). Additionally, individuals working in specialized areas requiring mathematics are able to earn better pay and are more likely to be employed (Kena et al., 2016; Pay Scale Human Capital, 2017). Consequently, knowing and being able to use mathematics is a high-stake skill for today's job market. However, with nearly 120 million workers employed in over 7 million science, technology, engineering, and mathematics (STEM) occupations, a disparity exist between the number of African American workers and White workers employed and working in various STEM jobs (Landivar, 2013). According to Landivar (2013), in the year of 2011, 11% of African American workers were employed in 6% of the available STEM occupations compared to 67% of White workers employed in 70% of the same available STEM occupations. This disparity might be attributed to the low college graduation rates of African American students. As of 2017, the U.S. Census Bureau (2017) reported from 1964 to 2017, African American adults age 25 or older obtaining a Bachelor's Degree or higher was on the rise from nearly 5% to 22% over this 53-year time span.

According to the National Center for Children in Poverty (NCCP), the majority of students who come from low-income families have parents who have no college degrees (Douglas-Hall & Chau, 2007). Importantly to note, many African American children have been raised in single-parent homes and live below the poverty level (Parham, Ajamu, & White, (2011/2016). In 2017, Semega, Fontenot, and Kollar (2017) estimated over 26% of African American families were living below the poverty level compared to 11% of White families living below the poverty level.

To find ways to support and prepare African American students and other students of color for post high school, the College Career and Readiness Initiative (CCRI) was implemented by Virginia Department of Education [VDOE] (Garland et al., 2011). The researchers determined students having the highest probability of success in postsecondary institutions were those who scored at the advanced levels on their high school end-of-course mathematics and English Standards of Learning (SOL) assessments (Garland et al., 2011). Students who scored in the proficient range on reading, writing, and mathematics high school end-of-course assessments had a much lower probability of enrolling and succeeding in 4-year higher education institutions than did students who scored in the advanced proficient range (Garland et al., 2011). Moreover, Garland et al. (2011) concluded the achievement gaps in enrollment and perseverance in postsecondary education were unmistakably evident for minority students and those from economically disadvantaged families. Contrarily, when these students reached high achievement levels by participating in advanced courses in high school, earning Advanced Studies diplomas, and scoring advanced proficient on state assessments, the gaps in enrollment and persistence were substantially reduced or completely eliminated (Garland et al., 2011).

Although AP courses are available to high school students who meet the requirements, some students do not enroll in these courses (Hines, 2017). There is a need for transparency about what the courses entail and for addressing students' concerns in enrolling in such courses. In Hines's (2017) coaching role at a high school where he worked with both teachers and students, one particular assignment was to encourage students to enroll in AP classes. There were 40 African American students with a grade point average of 3.5 or higher who met the requirements to sign up for AP classes. However, by interviewing each of the students who met the AP requirements, Hines (2017) determined these students lacked awareness of Advanced Placement (AP) courses, were not interested in taking AP courses, or were informed that AP courses were stressful and declined in having challenging courses added to their course load. While working with 14 of the African Americans students who expressed interest in taking AP courses, Hines (2013) utilized a culturally relevant approach to enlighten these students on the impact AP courses might have on their short and long term goals through several sessions, observations of AP courses, and networking opportunities with students already participating in AP courses. Thus, Hines (2017) was able to influence 70% of the 14 African American students he worked with to enroll in AP classes.

While some African American students display above average academic skills, many African American students struggle in mathematics. Based on the results of the 2011 National Assessment of Educational Progress (NAEP) Fourth-Grade Mathematics Subtest, African American students' average scaled scores were 25 points lower than for

White students (National Center for Education Statistics [NCES], 2011). This gap in mathematics achievement further increased for African American eighth-grade students in comparison to their White counterparts by an average scaled score of 31 points. Thus, the results of the NAEP assessments have continued to confirm the disproportionate academic gains in mathematics by African American children in comparison to White children at the same age and grade level (NCES, 2011). In fact, mathematics scores of Grade 4 African American students have remained constant over the past four years indicating no growth (NAEP, 2017). Currently, from recent mathematics results on the NAEP assessments (2017), the mathematics scores of Grade 4 African American students declined, while Grade 4 White students' mathematics scores remained constant (NAEP, 2017).

One factor that might have influenced this downward spiral in academic achievement of African American students is disengagement in school. Researchers (Barringer, Pohlman, & Robinson, 2010; Becker & Luthar, 2002; Casteel, 1997; Levine, 2002; Preckel, Holling, & Vock, 2006) suggested that when students are not engaged in lesson activities, do not have a sense of well-being, and do not have hope or goals for the future, they are not apt to learn in school. Additionally, based on the findings from the Gallup Student Poll Survey administered to K-12 students, Lopez (2010) concluded hope, engagement, and well-being are influential factors in leading to students' academic achievement. Another important finding from the survey was that student engagement peaked during elementary school as students were more involved in the learning process.

However, through middle school, students' participation in class activities decreased. In early high school, students' involvement in their learning stabilized a little, and then increased through the remainder of high school. Lopez (2010) believed that although some students in the upper elementary grades are physically present at school, they are mentally disengaged from the learning activities taking place in the classroom. Eventually, some of these same students drop out in middle school as their involvement in and enthusiasm for school degenerates from Grades 5 through 10 (Lopez, 2010). For African American students, specifically, boys, some researchers believe that disengagement begins as low as Grade 4 (Kunjufu, 2007; Parham, Ajamu, & White, 2011/2016).

Moreover, a number of African American boys have been diagnosed with Attention Deficit Hyper-Activity Disorder (ADHD) and might engage in behaviors of opposition and aggressiveness (Kunjufu, 2011). Needless to say, these types of behaviors impact the learning achievement of many African American boys because some teachers might have less tolerance for working with students who do not possess teachers' preferred student-qualities—compliance and cooperation (Brophy & Good, 1974; Wilkins, 2014). Roderick (2003) reported that ninth-grade teachers viewed African American boys more negatively than in comparison to other students. Xu (2010) in his investigation on gender and homework management of 685 African American students in secondary school settings concluded African American girls compared to African American boys were more inclined to engage in learning behaviors that supported their academic achievement. Further, Pollard (1993) believed teachers preferred teaching African American girls as opposed to African American boys. Although African American children struggle as a whole in mathematics compared to their White peers as previously mentioned, African American boys perform below African American girls and other boys. Moreover, African American boys are less likely to be provided an opportunity to learn in ways that complement their learning characteristics (Kunjufu, 2011) and are less likely to benefit from instruction in both urban and suburban classroom environments (Ramirez & Carpenter, 2005). Hence, many African American boys will continue to struggle and remain at-risk for academic learning unless we as educators provide positive ways to meaningfully engage these students in the academic learning processes, specifically in mathematics.

Background of Study

As a former teacher in a one-room school house, President Johnson believed education was the key to breaking the cycle of poverty (Sass, 2010). One policy enacted was the establishment of Head Start in 1964, a preschool program aimed at preparing disadvantaged children with academic readiness skills for the first grade. This early childhood program was followed by the Elementary and Secondary Education Act (ESEA) of 1965. The program provided federal funds to help low-income students, thereby resulting in the initiation of educational programs such as Title I, Bilingual Education, and Follow-Through programs (to complement the gains made by children who participated in Head Start). At the beginning of the 21st Century, the No Child Left Behind (NCLB) Act of 2001 was signed by President Bush on January 8, 2002 (U.S. Department of Education, Office of Elementary and Secondary Education, 2002). This law reauthorized ESEA to hold schools accountable for student achievement levels. Additionally, penalties were assigned to schools not making adequate yearly progress (AYP) toward meeting the goals addressed in NCLB. The goals comprised: (a) preparing, training, and recruiting high-quality teachers and principals; (b) promoting informed parental choice and innovative programs; (c) establishing 21st Century Schools; and (d) providing language instruction for limited English proficient and immigrant students (U.S. Department of Education, Office of Elementary and Secondary Education, 2002. More than 50 years of reforming education has passed and billions of dollars have been expended on educational programs (U.S. Department of Education, Office of Elementary and Secondary Education, 2002); however, there is still a substantial academic achievement gap between minority students and their White peers (Guskey, 2005; Muhammad, 2009; U.S. Department of Education, Office of Elementary and Secondary Education, 2002).

Theoretical Framework

Urie Bronfenbrenner’s ecological systems theory in human development is the theoretical framework that was used to drive this study. He is revered as one of the leading world experts in the field of development psychology (Hammond, 2007; Härkönen, 2007). His theory has been cited in more than 40,000 research articles and books using the Google Scholar search engine. Researchers from the fields of psychology (e.g., Coll et al., 1996; Garbarino, 2011), sociology (e.g., Alwin, 2004; Kelly, Ryan, Altman, & Stelzner, 2000; Swafford, Ramsey, & Self-Mullens, 2015), and education (e.g., Morris & Reardon, 2017; Onwuegbuzie, Collins, & Frels, 2013) have made reference to Bronfenbrenner’s ecological systems theory (Härkönen, 2007). The theory places students as the *central force* in shaping environments, inducing feedback from them, and reacting to them with guidance and modeling from adult role models (Darling, 2007). Parents, caregivers, and teachers are primarily the ones who shape and frame children in the primary phases of their lives within their varied settings.

Bronfenbrenner believed society was the contributing factor that played a crucial role in molding children´s development, and this belief was significant to the construction of his theory. In his understanding, societal norms influenced everything about children to the minutest detail (Härkönen, 2007), which Bronfenbrenner (1977/2009) was able to capture in his definition on human development, as follows:

> The process through which the growing person acquires a more extended differentiated, and valid conception of the ecological environment, and becomes motivated and able to engage in activities that reveal the properties of, sustain, or restructure that environment at levels of similar or greater complexity in form and content. (p. 26)

The ecological systems theory comprises four levels with distinct environments children experience at different points and at varying degrees throughout their development from infancy into adulthood. These four levels include the microsystem, the mesosystem, the exosystem, and the macrosystem. Bronfenbrenner (1977/2009) referred to the first environment as the microsystem. He defined it as, "a pattern of activities, roles, and interpersonal relations experienced by the developing person in a given setting with particular physical and material characteristics" (p. 20). The microsystem involves the direct contact that children have in their immediate environment, including home, school church, membership with community groups, and other settings in which children are active participants. Within this system, young people directly interact with others as both giver and receiver in meaningful and engaging ways (Bronfenbrenner, 1977/2009).

The mesosystem, or the second environment, encompasses the relationships among the microsystems in children's lives. The possibility of children's experience in one setting might impact their behaviors in another setting. For instance, children who participate as a member of a community sports team might be ridiculed by other members on the team, which might have an adverse effect on those children playing organized group games at school in that they might find other students to tease. A more formal definition of the mesosystem is provided by Bronfenbrenner (1977/2009) as comprising, "the interrelations among two or more settings in which the developing person actively participates (such as, for a child, the relations among home, school, and neighborhood peer group; for an adult, among family, work, and social life)" (p. 23).

The third environment named by Bronfenbrenner is the exosystem. It refers to: "one or more settings that do not involve the developing person as an active participant, but in which events occur that affect, or are affected by, what happens in the setting containing the developing person" (Bronfenbrenner, 1977/2009, pp. 23-24). An example of how this environment might impact children is that parents might have a full time job and then decide to take on more responsibility by enrolling in higher level institutions to continue their education, thereby resulting in less quality time being spent with their children. Young people also can impact the exosystem to which their parents belong in that the children themselves might be involved in a field study experience requiring parent participation, resulting in possible unexpected time off from work.

The macrosystem is the fourth and final environment. Bronfenbrenner referred to it as, "consistencies, in the form and content of lower-order systems (micro-, meso-, and exo-) that exist, or could exist, at the level of the subculture or the culture as a whole, along with any belief systems or ideology underlying such consistencies" (2009, p. 24). The systems design in this environment differ in relation to socioeconomic, ethnic, religious, and other subcultural groups. Different belief systems and lifestyles influence and promote the ecological environments specific to each culture (Bronfenbrenner, 1977/2009).

This ecological systems theory by Bronfenbrenner helps to bring in the process of education, caring, and teaching as factors influencing the developmental outcomes of students (Härkönen, 2007). In the foreground of this theory is the developing person and the educational environment all-inclusive of the intertwining personal relationships, roles, actions, and processes. Bronfenbrenner (1977/2009) championed that engagement in activities with or in the presence of the developing person by others are critical in impacting a person's development. He also believed that the developing person is often intrigued and motivated independently to initiate activities in which the person has participated or to which he or she has been exposed involving other people. Therefore, the ecological systems theory served as a guide and a frame of reference throughout this research investigation.

Purpose of the Study

Most mathematics studies on African American students have been conducted using qualitative research methods, and fewer qualitative research studies exist on fourth- and fifth-grade African American boys and their achievement in mathematics. There have been several mixed research studies conducted on African American boys' achievement in mathematics at the secondary level (e.g., Berry, 2005; Ramirez & Carpenter, 2005); however, there have only been a few research studies conducted on fourth- and fifth- grade African American boys' attitudes of teacher-student relationships and their achievement in mathematics at the elementary level.

The purpose of the present 2-year longitudinal retrospective investigation was to determine whether there was a relationship between fourth- and fifth-grade African American boys' attitudes of teacher-student relationships and their mathematics achievement. Data from the Measuring Effective Teachers (MET) project conducted from 2009 through 2011 and sponsored by the Bill and Melinda Gates Foundation (2013a) was utilized in this study. Archived data from the MET project comprised students' individual responses from perception surveys and mathematics scores (Bill and Melinda Gates Foundation, 2013a). The test scores in mathematics were obtained from several state tests (e.g., Colorado, Florida, North Carolina, Texas) throughout the United States of America administered in the 2009-2010 and 2010-2011 school years from different groups of fourth- and fifth-grade African American boys during the MET project (Bill and Melinda Gates Foundation, 2013a).

Research Questions

The following research questions were utilized to guide this study:

1. What is the relationship between fourth-grade African American boys' attitudes toward teacher-student relationships and their mathematics achievement?

2. What is the relationship between fifth-grade African American boys' attitudes toward teacher-student relationships and their mathematics achievement?

Research Hypothesis

The research hypotheses tested for this study:

1. There is a relationship between fourth-grade African American boys' attitudes toward teacher-student relationships and their mathematics achievement.

2. There is a relationship between fifth-grade African American boys' attitudes toward teacher-student relationships and their mathematics achievement.

Significance of Study

Achievement gaps in enrollment and persistence in postsecondary education are evident for minority students and those from economically disadvantaged families (Garland et al., 2011). However, when these students reached high achievement levels—by earning Advanced Studies diplomas and advanced proficient scores on state assessments—the gaps in enrollment and persistence were substantially reduced or completely eliminated (Garland et al., 2011). Berry (2005) and Ladson-Billings (2009) reported success of African American students in learning mathematics from teachers who were culturally responsive, caring, and knowledgeable about the subject area. In other words, these teachers were able to design and to deliver instruction to meet the social and emotional needs of their students by providing hope and a sense of well-being (Barringer et al., 2010; Becker & Luthar, 2002; Casteel, 1997; Civic Enterprises, Bridgeland, Bruce, & Hariharan, 2013; Levine, 2002; Preckel et al., 2006; Weissberg & Cascarino, 2013). In my experience as a classroom teacher in both the general and special education settings, I have worked with fourth- and fifth-grade African American boys who found mathematics perplexing and uninteresting. Yet, by building strong, positive relationships with them and providing meaningful and engaging learning activities, they were able to experience success in mathematics.

Thus, the results from this 2-year longitudinal retrospective, quantitative research study adds to the body of literature to provide insights regarding the relationship between African American fourth- and fifth-grade boys' attitudes of teacher-student relationships and their mathematics achievement. With this knowledge, teachers and African American boys have the opportunity to engage in conversations that promote and build positive relationships and learning partnerships where African American boys are empowered in mathematics through meaningful, interactive experiences. Moreover, the findings of this 2-year longitudinal retrospective study can be used to inform administrators at the school level about the extent of staff development required for teachers in designing instruction to enhance mathematics skills of fourth- and fifth-grade African American boys in preparing them for college and career readiness.

Definition of Terms

Achievement gap. The achievement gap is defined by the Department of Education (2004) as "the difference between how well low-income and minority children perform on standardized tests as compared with their peers. For many years, low-income and minority children have been falling behind their White peers in terms of academic achievement" (Glossary of Terms, para. 2).

Effective teacher behaviors. Nussbaum (1992, p. 167) defines effective teacher behaviors as "those in-class behaviors of the teacher that are related directly either to positive student outcomes or positive evaluations of teaching."

Human development. Bronfenbrenner (1977/2009, p. 26) defined human development as, “the process through which the growing person acquires a more extended differentiated, and valid conception of the ecological environment, and becomes motivated and able to engage in activities that reveal the properties of, sustain, or restructure that environment at levels of similar or greater complexity in form and content”

Mathematical literacy. The Organization for Economic Co-operation and Development (OECD) Program for International Student Assessment (PISA) was established to evaluate education worldwide and to assess how students (i.e., 15 year olds) have acquired skills and knowledge in reading, mathematics, and science necessary for a productive life. PISA (OECD, 2010) has defined mathematical literacy as, “the capacities of students to analyze, reason and communicate ideas effectively as they pose, formulate, solve and interpret mathematical problems in a variety of situations” (p. 23).

Social-emotional learning. Social and emotional learning (SEL) involves the processes through which children and adults acquire and effectively apply the knowledge, attitudes, and skills necessary to understand and to manage emotions, to set and to achieve positive goals, to feel and to show empathy for others, to establish and to maintain positive relationships, and to make responsible decisions (Weissberg & Cascarino, 2013).

Teacher clarity. Chesebro, in his unpublished manuscript (as cited in Chesebro & McCroskey, 2001), thought of teacher clarity as a way that teachers disseminate subject area content using verbal and nonverbal messages to engage students in the learning process. Houser and Frymier (2009) explained, “When teachers are clear, they do things like use previews and summaries, they stress important points, use visual aids, and help students prepare for assignments” (pp. 48-49).

Delimitations

Delimitations were incorporated to support the purpose of this 2-year retrospective research study designed to gain insights about the relationship between fourth- and fifth-grade African American boys’ attitudes toward teacher-student relationships and their achievement in mathematics based on the mathematics scores of their states’ test administered during the 2009-2010 and 2010-2011 school years. Although there were other minority groups experiencing low academic achievement in mathematics, archived data from the MET project collected on the participants in this study were Grade 4 and 5 African American boys enrolled in mathematics courses in self-contained classrooms of teachers who also participated in the study. Due to the fact there were only six school districts that volunteered to participate in the MET project, another boundary set was archived data from only schools from those six large, urban school districts across the United States were obtained for this study (Bill and Melinda Gates Foundation, 2013a). Additionally, archived, 2-year longitudinal data on the states’ tests on mathematics scores and student perception surveys were obtained from the teachers in the aforementioned school districts having different groups of students for the 2009-2010 and 2010-2011 school years when the MET project was conducted (Bill and Melinda Gates Foundation, 2013a).

Limitations

In research studies—whether quantitative, qualitative or mixed—there are possibilities of both internal and external threats that can affect the validity of the findings. Benge, Onwuegbuzie, and Robbins (2012) contended that an examination of validity—also referred to as legitimation—is the most salient step in any research study. According to Onwuegbuzie (2003), there are at least 54 threats to internal validity and external validity which researchers must consider that can impact the findings over three phases of a quantitative research study: the research design and collection of the data, the analysis of the data, and the interpretation of the data. Specifically, there are 22 threats to internal validity and 12 threats to external validity identified by Onwuegbuzie (2003) at the research design and data collection phases. At the data analysis phase, there are 21 threats to internal validity and five threats to external validity (Onwuegbuzie, 2003). Finally, Onwuegbuzie (2003) identified eight threats to internal validity and three threats to external validity at the data interpretation phase. See Figure 1 for Onwuegbuzie's (2003) *Framework of Threats to Internal/External Validity*.

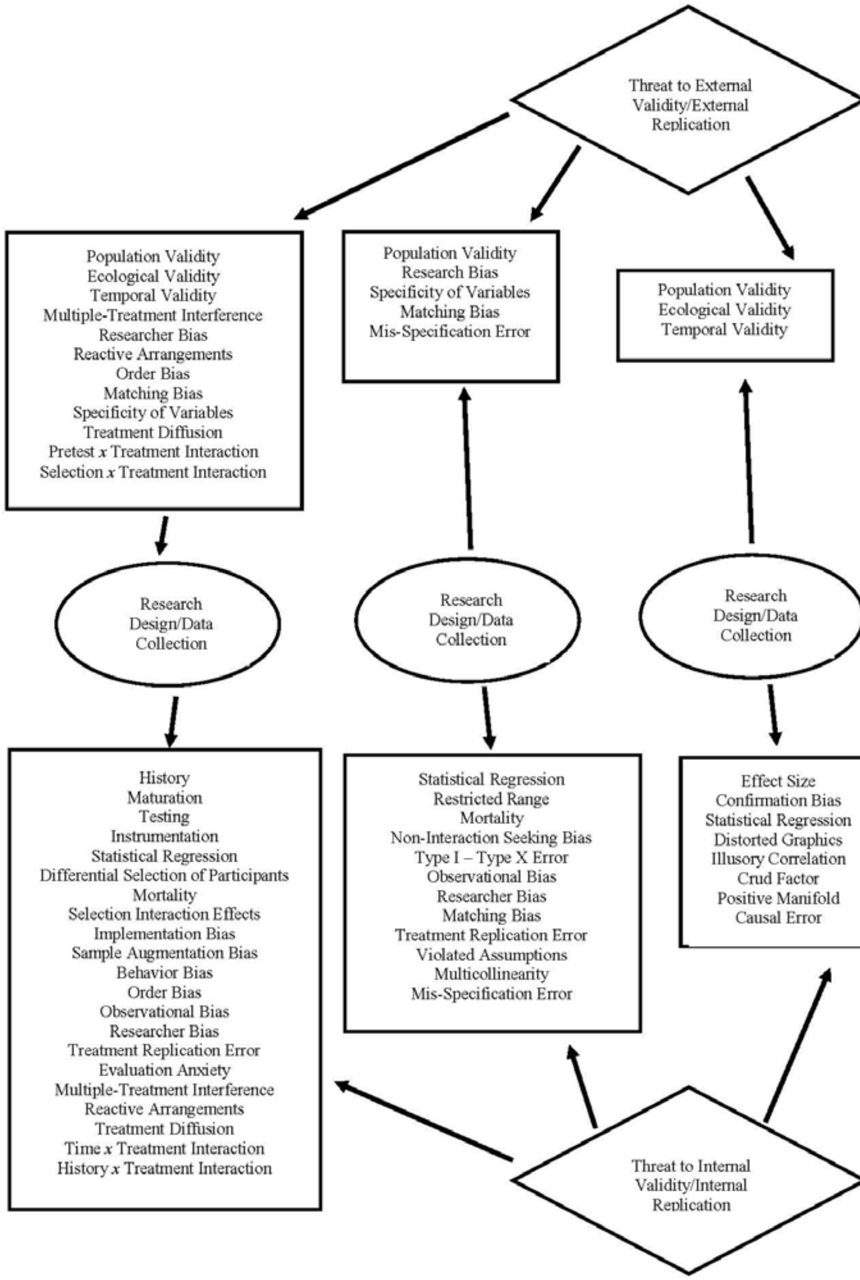

Figure 1. Major dimensions of threats to internal validity and external validity at the three major stages of the research process. "Expanding the Framework of Internal and External Validity in Quantitative Research," by A. J. Onwuegbuzie, 2003, *Research in the Schools*, *10*(1), pp. 71-90. Copyright [2003] by Mid-South Educational Research Association. Reprinted with permission. (See Appendix A)

An examination of threats considered by the researcher during this investigation using archived data will be discussed in detail.

The researcher in this 2-year retrospective, quantitative research investigation anticipated there were threats to the internal and external validity at the data collection phase in the MET project. The researcher also anticipated possible threats at the data analysis and data interpretation phases. At the design and data collection phases, the researcher identified 10 possible threats to internal validity and five threats to external validity that might have been encountered in the original study. For the data analysis phase, six possible threats to internal validity and three possible threats to external validity might have occurred in the current, retrospective study. Finally, in the data interpretation phase of the current, retrospective study, four threats to internal validity and three threats to external validity were considered.

Threats to internal validity at the research design and data collection phase. Gay, Mills, and Airasian (2014) state, "Validity is concerned with whether the data or information gathered is relevant to the decision being made" (p. 118). Internal validity refers to the results of the findings of a study attributed to by what the researcher actually did during the study and not by plausible external factors such as history, maturation, testing bias, etc. impacting the study (Campbell & Stanley, 2015; Springer, 2010). Creswell (2014) defines internal validity threats as "experimental procedures, treatments, or experiences of the participants that threaten the researcher's ability to draw correct inferences from the data about the population in an experiment" (p. 174). As noted previously, for the present, retrospective study, 10 possible threats to internal validity might have occurred at the research design and data collection phase in the MET project:

(a) history, (b) maturation, (c) testing (d) statistical regression, (e) differential selection of participants, (f) mortality, (g) implementation bias, (h) sample augmentation bias, (i) evaluation anxiety, and (j) reactive arrangements-novelty effect (Onwuegbuzie, 2003). Each of these threats is discussed in the following sections.

History occurs when external activities unattached to the study have an effect on the study (Campbell & Stanley, 2015). In this 2-year, longitudinal retrospective investigation, the threat of history was anticipated. There was a 3- to 5-month time span between the administration of the pre- and post-students' perception surveys. Students might have discussed the survey with their peers between administrations that might have influenced them to respond differently to survey questions on the post administration. Events within or out of school could have happened that might have impacted students' attitudes and behaviors toward testing and learning. Many threats to internal validity can be controlled for through random selection of participants and assignment to treatments (Gay et al., 2014; Springer, 2010). To minimize the threat of history in the MET project, the researchers randomly assigned teachers of general education classes where the teacher taught all content subject areas including English Language Arts (ELA) and mathematics to intact self-contained classrooms during Year 2 of the study (Bill and Melinda Gates Foundation, 2013a) to naturally formed classes. Moreover, within a classroom, all students were administered the perception survey simultaneously (Bill and Melinda Gates Foundation, 2013a).

Maturation is the changes in the physical, mental, emotional, and/or intellectual development of study participants over time (Campbell & Stanley, 2015; Gay et al., 2014). According to Gay (1996), the researcher cannot control when maturation occurs, but the researcher can plan for the manifestation of maturation. In the present 2-year longitudinal, retrospective study, the previous year's state test scores were utilized as a comparison to the results of the state's test obtained during the 2-year investigative period of the MET project. These state's tests were designed to increase the levels of complexity and expectations of learning mathematics objectives by age and grade appropriately as students matriculate through school.

Testing refers to variations in participants' scores on a post-test when a pre-test is administered and no treatment intervention has been provided prior to the administration of the posttest (Campbell & Stanley, 2015). According to Onwuegbuzie (2003), there are several reasons attributed to why a pre-test might lead to increased scores on a post-test: the study participants (a) are more knowledgeable about the format of the test and conditions, (b) have developed a technique for responding to the questions, (c) are not as apprehensive on additional administrations of the test, or (d) can remember some of their previous answers and can make necessary adjustments through reflection. During the 2-year MET project, participants were administered the student perception survey at four different periods in time. For each year of the study, the perception survey was administered in the fall and spring semesters. Due to these four administrations, students might have become familiar with the instrument and could either give more consideration or become uninterested in their responses. To maximize the internal validity due to the threat of testing, the researchers, as previously mentioned, randomly assigned teachers to intact classrooms during the second year of the study. Unless students were retained, there was an unlikely chance for them to have had the same teacher for both years of the MET project. The researcher of the present 2-year longitudinal, retrospective study hoped that the assignment of teachers to intact classrooms might have resulted in students' responses to the survey questions being more reflective as they considered the relationships with each of their teachers.

Statistical regression—also known as regression toward the mean—usually occurs when study participants are selected due to their very high or low performance outcomes (Gay et al., 2014). In educational research, statistical regression is a likely threat to internal validity. Campbell and Kenny (2003) emphasized that regression toward the mean is an artifact that can be due to large and extreme differences in the selection of participants in the control and experimental groups, matching, statistical equating, change scores, time-series studies, and longitudinal studies. B. Thompson, Diamond, McWilliam, Snyder, and Snyder (2005) declared, "The beauty of true experiments is that the law of large numbers creates pre-intervention group equivalencies on all variables, even variables that we do not realize are essential to control" (p. 183). Springer (2010) added that using a sample consisting of a fairly large number of study participants should minimize the chance of statistical regression effects when studying extreme variances in groups. For the present study, archived data collected on participants from the duration of the MET project were utilized. Due to the large number of participants with varied backgrounds, the researcher believed that there were a wide range of test scores from the archived data. To control for statistical regression, more than 2,500 students were enrolled in classrooms where the teachers who participated in the MET project had randomly been assigned. Thus, randomization of participants (Gay et al., 2014) and the large group size (B. Thompson et al., 2005) should have maximized internal validity concerning the threat of statistical regression.

Differential selection of participants—also known as selection bias—refers to numerous variances between two or more of the control groups and the experimental groups prior to the administration of any treatment (Campbell & Stanley, 2015). According to Onwuegbuzie (2003), controlling for randomized studies in educational settings is challenging for the researcher to conduct. He recommended that equivalency checks of groups be assessed by comparing the control and experimental groups with as many variables as possible in addition to the use of randomization (Onwuegbuzie, 2003). Nevertheless, the differential selection of participants will always exist as a threat to internal validity when groups are compared (Onwuegbuzie, 2003). In this 2-year longitudinal, retrospective study, archived data on study participants will be selected on a convenient basis. These study participants represented the population of their school districts and served as their own control group. All participants participated in their states' mathematics assessment and the administration of the perception surveys. For Year 1, whole classes of students participated in the study provided that they had been enrolled in the classrooms of participating teachers. In Year 2, students were enrolled in classrooms where participating teachers had randomly been assigned. As previously mentioned, the large number of students participating in the study should have minimized most threats to internal validity.

Mortality—also known as attrition—occurs when study participants fail to take part or to participate for the whole duration of the study in a way that impacts the results (Campbell & Stanley, 2015). In the MET project, some schools, teachers, and students did not participate throughout the duration of the study for various reasons. To control for the threat of mortality, archived data of study participants who participated in Year 1 and Year 2 of the MET project and in which previous test scores were available prior to the start of the MET project were included in the present longitudinal, retrospective investigation. Moreover, participants served as their own control group.

As noted by Onwuegbuzie (2003), implementation bias involves "the protocol designed for the intervention not being followed in the intended manner (i.e., protocol bias)" (p. 77). Moreover, according to Onwuegbuzie, implementation bias is "a common and serious threat to internal validity" (p. 77). Implementation bias might stem from varied experiences of teachers, the number of participating teachers, and time (Onwuegbuzie, 2003). During the MET project, a large number of teachers with varied years of experience participated and administered the perception surveys to their students. School districts' testing procedures on their states' tests were different in that some districts' teachers tested their own students, whereas other districts' teachers tested other teachers' students. To control for implementation bias, teachers were given the option to participate voluntarily in the MET project. The researcher of the present 2-year longitudinal, retrospective study hopes that because the teachers participated on a voluntarily basis, they would have been more likely to have stayed true to the established protocols for administering the student perception surveys and state tests.

According to Onwuegbuzie (2003), sample augmentation bias occurs when participants join a study after the study has begun, thereby impacting the results in some manner. To control for the threat of sample augmentation, archived data from the MET project participants who participated in Year 1 and Year 2 of the study and in which previous test scores were available prior to the start of the study were included in the present longitudinal, retrospective study. Here, as well, participants served as their own control group.

Evaluation anxiety occurs when participants at any level of the educational process are uncomfortable with testing (Onwuegbuzie, 2003). According to Onwuegbuzie (2003), researchers should be aware of the confinement of the testing environment at the design/data collection phase because it has the potential to threaten internal validity by introducing systematic error into the measurement. Study participants who have high levels of test anxiety might not perform as well as do students who have low test anxiety; and, yet, researchers might not obtain a true picture of the actual ability of those students who have high levels of test anxiety (Hill & Wigfield, 1984). During the MET project, participants were exposed to the administration of their annual states' tests in all subjects areas required for that particular grade level. For example, some states (e.g., Colorado, Florida, Texas, North Carolina) tested their fourth-grade students in reading, writing, and mathematics, and their fifth-grade students in reading, mathematics, and science (Bill and Melinda Gates Foundation, 2013a). Students were administered classroom tests according to each teacher's practices. Additionally, students enrolled in classrooms where the teacher who participated in the MET project had randomly been assigned were administered an additional comprehensive mathematics assessment. Students who had taken the mathematics assessments also completed the perception survey for reflecting on their attitudes' toward their relationship with their mathematics teacher. In other words, students had been instructed to rate their attitudes of their teacher-student relationship focused on the instruction/support during mathematics time. The researcher of the present 2-year longitudinal study believed that the threat of evaluation anxiety was present in the MET project due to the number of testing situations previously mentioned. The researcher hoped that the testing environments were conducive to students' physical and mental needs (e.g., restroom breaks, stretch breaks, brain breaks, snacks).

The internal validity threat, reactive arrangements, refers to the way study participants respond when they are aware they are a part of a research study that might either increase/decrease the engagement of participants (Onwuegbuzie, 2003). In the MET project, one requirement was that volunteered teacher participants agree to have their lessons video-taped. As a result, students' responses to instruction might have had a novelty effect on their states' mathematics assessment and/or the perception survey. Additionally, teachers might have been overly nurturing to students to receive favorable responses from the perception surveys completed by students. To control for these threats to reactive arrangement possibly due to a novelty effect, the MET project took place over a 2-year period with bi-annual administrations of the perception survey and annual administration of the states' tests for mathematics (Bill and Melinda Gates Foundation, 2013a). According to Onwuegbuzie (2003), the novelty effect decreases or fades away over an extended period of time as participants become used to the stimuli.

Threats to internal validity at the research design and data analysis phase. Six threats to internal validity at the data analysis phase of the study might occur. They include Type I error, Type II error, violated assumptions, multicollinearity, mortality (previously mentioned), and statistical regression (previously mentioned). According to Daniel and Onwuegbuzie (2000, p. 10), Type I errors occur when "the null hypothesis has been rejected in error" by researchers. In the present, retrospective study, the Type I error was controlled using the Bonferroni adjustment to the statistical test performed (Onwuegbuzie & Daniel, 2002). Additionally, close attention was given to the setting of the significance level or *alpha* by considering the theoretical framework (Springer, 2010), the significance level, and p-value from the MET project, and similar studies (B. Thompson et al., 2005).

Daniel and Onwuegbuzie (2000, p. 11) refer to Type II error as “the likelihood of failing to reject a null hypothesis that is false in the population of interest.” To control for this Type II error, large sample sizes were utilized in performing statistical tests. (Onwuegbuzie, 2003; Onwuegbuzie & Daniel, 2002; Springer, 2010). Archived data from the MET project was selected through convenience sampling on more than 2,500 African American boys in Grades 4-5.

The use of statistical methods requires ascertaining assumptions (B. Thompson et al., 2005). According to Onwuegbuzie (2003, p. 84), violated assumptions occur when researchers “do not adequately check the underlying assumptions associated with a particular statistical test.” In the current, retrospective study, assumptions were checked and evidence that the assumptions were appropriate is presented (Onwuegbuzie & Daniel, 2003; B. Thompson et al., 2005).

Onwuegbuzie and Daniel (2003, p. 8) declared that “Multicollinearity occurs when two or more independent variables are highly related. When one independent variable is perfectly correlated with other independent variables, the parameter estimates are not uniquely determined.” In the current retrospective study, multiple independent variables from the archived data taken from the Tripod Student Perception Survey in the MET project were utilized. Multicollinearity was assessed on all statistical analyses.

Threats to internal validity at the research design and data interpretation phase. There were four possible threats to the data interpretation phase of this retrospective study. They included effect size, confirmation bias, distorted graphics, and causal error. According to Springer (2010, p. 310), an effect size refers to "the magnitude of a significant effect. The effect size is a specific number that constitutes an estimate of the strength of the effect." Onwuegbuzie and Daniel (2003, p. 9) emphasized that, "The non-reporting of effect sizes likely represents the most common interpretational error in quantitative research." Additionally, many researchers misinterpret statistical significance (Onwuegbuzie, 2003). In the present study, results from statistical tests included descriptive statistics (e.g., sample size, means, correlations, standard deviations) so that the extent of the effect being reported should be clear to all readers and for possible use in future meta-analyses (Onwuegbuzie & Daniel, 2003; Springer, 2010; B. Thompson et al., 2005).

Confirmation bias occurs when researchers overly rely on new data to support the original hypotheses (Onwuegbuzie, 2003). Onwuegbuzie (2003) warns that confirmation bias is usually a threat to internal validity at the interpretation stage when other plausible rival explanations exist, but are not considered by the researchers. In the current, retrospective study, I utilized the theoretical framework to make assumptions and decisions about the underlying findings of the results to determine whether my hypotheses were supported (Onwuegbuzie, 2003). As mentioned previously, possible threats at all levels are being considered.

Distorted graphics occur when assumptions are made from graphs that are misleading (Onwuegbuzie, 2003). Onwuegbuzie (2003) suggests that researchers perform graphical checks or triangulate the results using empirical calculations (e.g., kurtosis, skewness) and statistical tests of normality. In this study, statistical methods will be employed. Additional testing was undertaken so as not to rely on only one portion of information in interpreting the findings of my study.

Causal error occurs when researchers infer statistically significant relationships as cause-and-effect in an uncontrolled study (Onwuegbuzie, 2003). B. Thompson et al. (2005) believe that correlational designs can be used to inform “causal inferences and thus evidence-based practice” (p. 182). Although the present, retrospective study was a correlational study to determine whether there is indeed a relationship between students’ perception of teacher-student relationships and mathematics achievement, evidence was provided to support possible causal inference and the possible strength of the relationship through statistical methods and logical explanations (e.g., history, maturation). See Table 1 for threats to internal validity at all three stages.

Table 1

Threats to Internal Validity

Phase of Design/Limitation	Description	Manifestations in Current Study
Research design/data collection:		
History	External activities unattached to the study have an effect on the study	A time period of 3 to 5 months spanned the administration of the student perception survey. During the 2-year period, students were administered the survey in the fall and spring of each year.
Maturation	Changes in the physical, mental, emotional, and/or intellectual development of study participants over time	Participants participated in this study over a 2-year period.
Testing	Refers to variations in participants' scores on a post-test when a pre-test is administered and no treatment intervention has been provided prior to administration of the posttest.	A time period of 3 to 5 months spanned the administration of the student perception survey. During the 2-year period, students were administered the survey in the fall and spring of each year.
Differential selection of participants	Refers to the imbalanced selection of study participants	Participants in this 2-year longitudinal retrospective study were selected on a convenience basis at the student level.

(continued)

Implementation bias	Refers to the inconsistency of administering the measurement tool to study participants	A large number of teachers with varied years of experience participated in the MET 2-year longitudinal project and administered the perception surveys to their students. School districts' testing procedures on their states' tests might be different in that some teachers test their own students, whereas teachers in other districts test students of other teachers.
Sample augmentation bias	Happens when study participants join a study after the study has begun, thereby impacting the results in some manner	Some students did not participate in Year 1 of the MET project.
Evaluation anxiety	Occurs when participants at any level of the educational process are uncomfortable with testing	More than 2,500 fourth- to fifth-grade African American boys participated in the 2-year longitudinal MET project and were administered the perception survey at four points in time. The same students participated in multiple assessments required at the state, district, classroom, and present research study MET project.

(continued)

Reactive arrangements-novelty effect	Refers to the way that study participants respond when they are aware that they are a part of a research study—increased engagement of participants	Teacher participants during the MET project might have been overly nurturing to students to obtain favorable students' responses on the student perception surveys. Video cameras were placed in each participating teachers' classroom and lessons were video-taped.
Research design/data collection/data analysis:		
Statistical regression	Occurs when study participants are selected beyond the average range or longitudinal studies	More than 2,500 participants with varied test scores participated in the MET project for a 2-year period.
Mortality	Occurs when study participants fail to take part or to participate for the duration of the study, thereby impacting the results	Some teachers and students did not participate in both years of the MET project for various reasons.
Research design/data analysis:		
Type I	Occurs when the null hypothesis has been rejected in error by researchers	Assumptions were made using a null hypothesis.
Type II	Occurs when researchers fail to reject a null hypothesis that is false in the population of interest	Archived data on 2,500 participants were used in this retrospective study.

(continued)

Violated assumptions	Failing to check the underlying assumptions of statistical tests by the researchers	Statistical methods were utilized and such methods involve researchers to make assumptions.
Multicollinearity	Occurs when the presence of one variable impacts the predictive power of another variable	Multiple independent variables taken from the Tripod Student Perception Survey obtained in the MET project were utilized.
Research design/data interpretation:		
Effect size	Refers to the magnitude or extent of a significant effect.	Statistical tests were utilized in the present study.
Confirmation bias	Occurs when researchers overly rely on new data to support original hypotheses	Decisions were made about the results generated from using statistical methods.
Distorted graphics	Occurs when assumptions are made from graphs that are misleading	Statistical methods were utilized in the present, retrospective study.
Causal error	Occurs when researchers infer statistically significant relationships as cause-and-effect in an uncontrolled study	This was a correlational study to determine whether there is indeed a relationship between students' perception of teacher-student relationships and mathematics achievement.

Threats to external validity at the research design and data collection phase. External validity refers to the generalizability or to what extent the results can be applied beyond the original study (Campbell & Stanley, 2015; Springer, 2010). Creswell (2014) claimed, "External validity threats arise when experimenters draw incorrect inferences from the sample data to other persons, other settings, and past or future situations." (p. 176). As noted previously, for the present, retrospective study, five possible threats to external validity might have occurred at the research design and data collection phase in the MET project: (a) specificity of variables, (b) population validity, (c) ecological validity, (d) temporal validity, and (e) researcher bias (as previously mentioned) (Onwuegbuzie, 2003). Each of these threats is discussed in the following sections.

According to Onwuegbuzie (2003),

> Specificity of variables refer to the fact that any given inquiry is undertaken utilizing (a) a specific type of individual, (b) at a specific time, (c) at a specific location, (d) under a specific set of circumstances, (e) based on a specific operational definition of the independent variable, (f) using specific dependent variables, and (g) using specific instruments to measure all the variables. (p. 81)

Additionally, Onwuegbuzie warns that specificity of variables is a threat to external validity in many studies (Onwuegbuzie, 2003). In the present, retrospective study, archived data covering six large school districts with more than 2,500 fourth- and fifth-grade African American students including those receiving services in special education, gifted and talented, and the general education class were included in the study. To control for threats due to specificity of variables, the researcher was extremely cautious in generalizing results.

Population validity is defined by Springer (2010) as, "the extent to which experimental results can be generalized to a larger group of individuals" (p. 189). Onwuegbuzie (2003) adds that using large sample sizes tend to minimize the threat of extending population validity to the findings of a study. In the present, retrospective study, archived data of more than 2,500 fourth- and fifth-grade African American students including those receiving services in special education, gifted and talented, and the general education class were included in this study.

Onwuegbuzie (2003) explained, “ecological validity refers to the extent to which findings from a study can be generalized across settings, conditions, variables, and context” (p. 80). Ecological validity also might be a threat to most educational research studies because schools and school districts differ on variables such as ethnicity, socioeconomic status, and academic achievement (Onwuegbuzie, 2003). In the present, retrospective study, archived data covering six large school districts with more than 2,500 fourth- and fifth-grade African American students including those receiving services in special education, gifted and talented, and the general education class were included in the study. To control for the threat of ecological validity, the researcher was extremely cautious in generalizing results.

According to Onwuegbuzie (2003), “temporal validity refers to the extent to which research findings can be generalized across time” (p. 80). Temporal validity is a threat to educational research because many researchers in the educational setting conduct experiments at one point in time and, thus, fail to consider whether the results would be the same at a different point in time. To control for the threat of temporal validity, archived data from the 2-year longitudinal MET project were used in the present, retrospective study.

Threat to external validity at the research design, data analysis, and data interpretation phase. Possible threats to external validity at the data analysis phase included previously mentioned (a) specificity of variables, (b) researcher bias, and (c) population validity. Possible threats to external validity at the data interpretation phase included previously discussed (a) population validity, (b) ecological validity, and (c) temporal validity. See Table 2 for threats to external validity at all three stages.

Table 2

Threats to External Validity

Phase of Design/Limitation	Description	Manifestations in Current Study
Research design/data collection/data analysis:		
Specificity of variables	Refers to the unique variables of participants, time context, conditions, and variables	Archived data covering six large school districts with more than 2,500 fourth- and fifth-grade African American students including those receiving services in special education, gifted and talented, and the general education class were included in the study.
Research design/data collection/data analysis/data interpretation:		
Population validity	Refers to how far the results of a study can be applied to and across populations	Archived data of more than 2,500 fourth- and fifth-grade African American students including those receiving services in special education, gifted and talented, and the general education class were included in the study.

(continued)

Phase of Design/Limitation	Description	Manifestations in Current Study
Research design/data collection/ data interpretation:		
Ecological validity	Refers to how far the results of a study can be applied across settings, conditions, variables, and context	Archived data covering six large school districts with more than 2,500 fourth- and fifth-grade African American students including those receiving services in special education, gifted and talented, and the general education class were included in the study.
Temporal validity	Refers to how far the results of a study can be applied across time	More than 2,500 participants with varied test scores participated in the MET project for a 2-year period.

Assumptions

This retrospective research study included several assumptions. The first assumption was that the participants in the MET project responded to the perception survey truthfully. Secondly, the participants understood the vocabulary and comprehended the questions in the perception survey. Thirdly, the participants responded to the mathematics assessments with integrity. Fourthly, the participants comprehended accurately to items on the mathematics assessments. Finally, participants felt at ease taking both the perception surveys and the mathematics assessments.

Organization of the Remaining Chapters

The remaining four chapters in the present study focus on the review of the literature, the methodology of the study, the analysis of the data, and the discussion and implication of the findings. Chapter II comprises a review of the literature on mathematical literacy, teachers' effects (i.e., clarity, immediacy, verbal behavior, and content and pedagogical knowledge), social and emotional learning, and strategies for engaging African American boys in mathematical content. Chapter III comprises detailed information about the research method, the selection of participants, the instrumentation, the data collection, and the data analysis procedures. Chapter IV comprises the analysis of the data. Finally, Chapter V comprises a summary, a discussion of the findings, recommendations for research, and implications for practice.

CHAPTER II

Literature Review

The number of vocations that necessitate a high level of ability in the use of mathematics and mathematical thinking has proliferated with the advancement of technology (Mullis, Martin, Ruddock, O'Sullivan, & Preuschoff, 2009). Policy makers in the United States realize that a U.S. workforce equipped with the understanding of mathematics and using mathematics skills is a prerequisite in attracting businesses to provide jobs that will ultimately boost and sustain the nation's economy, (Mullis et al., 2009). As a result, educators in school systems play a major role in supporting and preserving the American way of life. Among the numerous assigned duties, teachers are tasked with effectively preparing young scholars in the fields of mathematics and science for technical-level jobs (e.g., medical doctor, engineer, physicist), non-technical jobs (e.g., agriculture, healthcare, banking and finance), and jobs not yet created (Hodgen & Marks, 2013). NCTM (2011) strongly affirms that teachers and what they do in the classroom are at the heart of promoting the quest for mathematics understanding and using mathematics in school and in life. Yet, U.S. students' low mathematics performance at the international level (Gonzales et al., 2008; NCES, 2017) and national level (NAEP, 2017) has caused concern about the teaching and learning of mathematical literacy skills in the classroom.

In an effort to improve the mathematics education of U.S. students, considerable amounts of research studies have been completed encompassing the most effective ways of teaching and learning mathematics (Brophy & Good, 1970; Ridlon, 2009). However, the rich description of real-time context, conditions, and teacher-student interactions have gone unsolicited by policy makers and educational administrators in the need to improve students' mathematics academic success (Brophy & Good, 1970; Ridlon, 2009).

Students are constantly and actively appraising and assessing their classroom environments (Blumer, 1980). They make meaning of their interactions or lack of interactions with their teachers and other classmates. Importantly, some teachers' behaviors might be perceived as being positive or negative by students and, often times, these perceptions might not be manifested openly, but could impact students' learning (Bronfenbrenner, 1977/2009).

Although mathematics is a challenge for many students in the United States (Baroody & Dower, 2003/2009; Kastberg, Chan, & Murray, G., 2016; NCES, 2017; OECD, 2016b), African American boys have the lowest attainment in mathematics when compared to that of their peers based on test scores at the national level (American College Testing [ACT], 2017; NCES, 2017; OECD, 2016b). Incorporating the ecological systems theory in human development as the frame of reference, focal points of this review of the literature includes mathematical literacy, effective teachers' behaviors, social and emotional learning, and strategies for engaging African American boys in mathematical content. Please see Table 3 for the alignment of the focal points of this literature review with the theoretical framework.

Table 3

Focal Points of Literature Review Aligned with Bronfenbrenner's Ecological Systems Theory

Focal Points	Microsystem	Mesosystem	Exosystem	Macrosystem
Mathematical Literacy	Students might have positive experiences learning mathematical concepts from knowledgeable teachers of mathematics that might influence their affinity to taking advanced-level mathematics courses as they matriculate through school.	Students might provide peer tutoring in mathematics to their friends and relatives in and out of the school community. Parents might also work with teachers to ensure that their children are receiving appropriate mathematics instruction at each grade level.	Teachers might receive professional development training that might help them to differentiate instruction to meet the needs of diverse learners.	Many places of employment require individuals to be able to understand mathematical concepts and use their mathematics skills to problem solve.
Effective Teachers' Behavior	Students might watch the behaviors of teachers and replicate those same behaviors. For instance, if the teacher shows enthusiasm for teaching mathematical concepts, the students might come to share similar behaviors.	Students might model their positive behaviors toward mathematics to their friends and relatives.	Teachers might be held accountable for their students' results on state/district mathematics examinations	Teachers might strive to provide all students the opportunity to learn mathematics in an engaging and meaningful way.

(continued)

Focal Points	Microsystem	Mesosystem	Exosystem	Macrosystem
Social and Emotional Learning	Students who learn how to be aware of their emotions and how to cope with them might build positive relationships with other people.	Students might display empathy for other peers and adults in and out of the school community.	Teachers and parents might attend trainings to help them become aware of their own emotions and how it impacts positive relationships with the students.	Students might increase their understanding and appreciation for other cultures in this global society.
Strategies for engaging African American boys in mathematical content	Students who are provided a repertoire of meaningful and engaging strategies and lesson activities in the mathematics class might learn the mathematical concepts and become more responsible for their own learning.	Students might choose to engage in mathematics activities in and out of school (e.g., clubs, competitions, math coach).	Teachers might find ways to enhance students' application of learning mathematics by participating in, but not limited to, mathematics professional learning communities, conferences, and other professional developing trainings.	Teacher development centers and postsecondary institutions might use positive and effective current practices to design preparation courses and trainings in the teaching of mathematics to African American boys.

The first topic will address mathematical literacy—how it is defined and the domains that constitute whether individuals are mathematically literate. The second topic will address teachers' effects (Nussbaum, 1992), specifically:

1. Teacher clarity—how teachers use their instructional practices and strategies to appeal to students' senses in the learning process;
2. Teacher immediacy—how teachers use their verbal and nonverbal behaviors to make students feel welcomed.

3. Teachers' content and pedagogical knowledge—the extent of knowing the subject matter and the strategies used to disseminate that information to students

The third topic will address social and emotional learning—what it is and its value to educators in preparing 21st century scholars for today's society. Finally, the fourth topic will address strategies for engaging African American boys in mathematics content—the use of various teaching modalities to motivate these students in the learning process and to increase retention of mathematics concepts.

Mathematical Literacy

We use technology in almost every aspect of our lives—in our homes, in our schools, and in our workplaces. With the influx of technology, many jobs are dependent on workers having mathematical literacy (Hodgen & Marks, 2013). What is mathematical literacy? What are the domains of mathematical literacy and how are students assessed? Why is it important for students to have mathematical literacy? What are policy makers and educational leaders in the United States undertaking specifically to address mathematical literacy? The answers to these questions will be discussed in this section.

Mathematical literacy defined. The OECD is a world organization comprising 34 democracies, with free market economies working with one another, as well as with more than 70 non-member economies, to promote economic growth, prosperity, and sustainable development (United States Mission to the OECD, 2017). In an effort to address the question, "What is important for citizens to know and be able to do?" (OECD, 2016a, p. 10), Program for International Student Assessment (PISA) was developed. The purpose of PISA was to assess 15-year old students once every 3 years in science, reading, and mathematics toward the end of their compensatory education to determine the extent of their acquired knowledge and skills for being able to have a productive life (OECD, 2016a). Concerning mathematics, what is important for individuals to know and be able to undertake mathematics at the international level is embedded in the definition of mathematical literacy. OCED (2016a) stated,

> Mathematical literacy is an individual's capacity to formulate, employ and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts, and tools to describe, explain and predict phenomena. It assists individuals in recognising the role that mathematics plays in the world and to make the well-founded judgements and decisions needed by constructive, engaged, and reflective citizens. (p. 65)

In addition to testing for mathematical literacy, PISA assessments are designed to examine whether students can use their acquired knowledge and skills in various contexts to which students might have not been accustomed in or out of school (OECD, 2016a). Expecting students to know and to demonstrate application of their mathematics competencies on the administered international assessments is representative of the basis for which workers are recognized and rewarded in the present-day business sectors (OECD, 2016a). For this reason, the framework of the PISA assessments include various domains applicable to real-world situations.

Domains of the PISA mathematics assessments. To ensure that items developed for the PISA assessment reflect the definition of mathematical literacy, several domains are considered. They include mathematical processes and fundamentals, mathematical content, and context. These domains, when considered as a whole in constructing test items, are meant to operationalize the definition of mathematical literacy (OECD, 2016a).

Mathematical processes and fundamentals. Mathematical processes involve what individuals do to connect the context of problems with the mathematics content to solve mathematical situations. In addition, mathematical processes involve several skill sets: (a) formulating or expressing situations mathematically; (b) employing or using mathematical concepts, facts, procedures, and reasoning; and (c) interpreting, applying, and evaluating mathematical outcomes. Moreover, for students to engage in these mathematical processes, they need inherent underlying fundamentals or cognitive capabilities including: (a) communicating; (b) mathematizing; (c) representing; (d) reasoning; (e) devising strategies for solving problems; (f) using symbolic, formal and technical language and operations; and (g) using mathematical tools (OECD, 2016a).

Mathematical processes. In the process of formulating, students are expected to recognize and to identify opportunities to use mathematics in problem situations and to provide a mathematical representation of the contextualized problem (e.g., identifying variables, creating a model, simplifying a situation or problem, using technology to portray a mathematical relationship). In the process of employing, students are expected to apply mathematical concepts, facts, procedures, and reasoning to devise and to implement a plan of operation to find a mathematical solution to mathematically formulated problems (e.g., performing computations, manipulating numbers, extracting mathematical information, applying mathematical rules, explaining and justifying mathematical results). In the process of interpreting, applying, and evaluating mathematical outcomes, students are expected to analyze mathematical solutions in the context of problems and to determine whether the results are reasonable and make sense in the context of various problem situations (OECD, 2016a).

Mathematical fundamentals. The fundamental mathematical capabilities underlying the mathematical processes and mathematical literacy in practice are instrumental in the mathematical behavior exemplified by students to solve mathematical situations (OECD, 2016a). As previously mentioned, the fundamentals or cognitive capabilities are as follows: (a) communicating; (b) mathematizing; (c) representing; (d) reasoning; (e) devising strategies for solving problems; (f) using symbolic, formal and technical language and operations; and (g) using mathematical tools are needed to understand and to view the world with a mathematical lens or to solve problems (OECD, 2016a). According to Turner and Adams (2012), as students' mathematical literacy skills increase, the degree to which they are able to apply the necessary fundamental capabilities also increases. See Table 4 for the fundamental capabilities across all three stages of the mathematical processes.

Table 4

Relationship Between Mathematical Processes and Fundamental Mathematical Capabilities.

	Formulating situations mathematically	Employing mathematical concepts, facts, procedures and reasoning	Interpreting, applying, and evaluating mathematical outcomes
Communicating	Read, decode, and make sense of statements, questions, tasks, objects or images, in order to form a mental model of the situation.	Articulate a solution, show the work involved in reaching a solution and/or summarise and present intermediate mathematical results.	Construct and communicate explanations and arguments in the context of the problem.
Mathematising	Identify the underlying mathematical variables and structures in the real-world problem, and make assumptions so that they can be used.	Use an understanding of the context to guide or expedite the mathematical solving process, (e.g., working to a context-appropriate level of accuracy).	Understand the extent and limits of a mathematical solution that are a consequence of the mathematical model employed.
Representation	Create a mathematical representation of real-world information.	Make sense of, relate, and use a variety of representations when interacting with a problem.	Interpret mathematical outcomes in a variety of formats in relation to a situation or use; compare or evaluate two or more representations in relation to a situation.

(continued)

	Formulating situations mathematically	Employing mathematical concepts, facts, procedures and reasoning	Interpreting, applying, and evaluating mathematical outcomes
Reasoning and argument	Explain, defend or provide a justification for the identified or devised representation of a real-world situation.	Explain, defend or provide a justification for the processes and procedures used to determine a mathematical result or solution. Connect pieces of information to arrive at a mathematical solution, make generalisations, or create a multi-step argument.	Reflect on mathematical solutions and create explanations and arguments that support, refute, or qualify a mathematical solution to a contextualised problem.
Devising strategies for solving problems	Select or devise a plan or strategy mathematically to reframe contextualised problems.	Activate effective and sustained control mechanisms across a multi-step procedure leading to a mathematical solution, conclusion, or generalisation.	Devise and implement a strategy in order to interpret, evaluate, and validate a mathematical solution to a contextualised problem.
Using symbolic, formal and technical language, and operations	Use appropriate variables, symbols, diagrams, and standard models in order to represent a real-world problem using symbolic/formal language.	Understand and utilise formal constructs based on definitions, rules, and formal systems as well as employing algorithms.	Understand the relationship between the context of the problem and representation of the mathematical solution. Use this understanding to help interpret the solution in context and gauge the feasibility and possible limitations of the solution.

(continued)

	Formulating situations mathematically	Employing mathematical concepts, facts, procedures and reasoning	Interpreting, applying, and evaluating mathematical outcomes
Using mathematical tools	Use mathematical tools in order to recognize mathematical structures or to portray mathematical relationships.	Know about and be able to make appropriate use of various tools that might assist in implementing processes and procedures for determining mathematical solutions.	Use mathematical tools to ascertain the reasonableness of a mathematical solution and any limits and constraints on that solution, given the context of the problem.

Note. Reprinted from "*PISA 2015 Mathematics Framework*" (In *PISA 2015 Assessment and Analytical Framework: Science, Reading, Mathematic and Financial Literacy*) by OECD Publishing, pp. 69–70. Copyright 2016 by Creative Commons licensed under NC-SA 3.0 IGO. (See Appendix B.)

Mathematical content knowledge. Understanding and having the ability to apply mathematical knowledge to problem situations in various contexts is essential in today's society. In the design of the PISA mathematical assessments, four content categories were utilized, as follows: (a) change and relationships, (b) space and shape, (c) quantity, and (d) uncertainty and data. Although these four categories serve as a foundation to recognize the span of mathematical content, many mathematical skills are central and often times apply across several content categories. Examples of mathematics content skills are as follows:

- Functions
- Algebraic expressions
- Equations and inequalities

- Co-ordinate systems
- Relationships within and among geometrical objects in two and three dimensions
- Measurement
- Numbers and units
- Arithmetic operations
- Percentages, ratios, and proportions
- Counting principles
- Estimation
- Data collection, representation, and interpretation
- Data variability and its description
- Samples and sampling
- Chance and probability

Change and relationships. Changes and relationships can be observed in different settings—such as weather patterns, development of organisms, and finances. Understanding change and relationships involves being familiar with basic types of change and recognizing when they happen in order to use appropriate mathematical models to explain and to predict changes. In mathematics, students are expected to model the change and relationships with the correct numerical expressions and/or create/interpret graphical representations of relationships. Other change and relationships involving mathematics stem from geometric measurement, statistics, functions and equations, and basic numbers and units (OECD, 2016a).

Space and shape. Geometry serves as an essential foundation for space and shape; however, in terms of mathematical literacy, it involves a range of activities including understanding views, creating and reading maps, transforming shapes with and without technology, construing views of three-dimensional scenes from various perspectives, and creating representations of shapes (OECD, 2016a).

Quantity. With respect to quantity, the knowledge of number and number operations are used in numerous settings in homes, in schools, in workplaces, and in communities. Counting and calculating numbers are used to describe and to measure various attributes of characteristics of the world. Quantification is used to model situations, to analyze change and relationships, to describe and to manipulate space and shape, to organize and interpret data, and to measure and assess uncertainty (OECD, 2016a).

Uncertainty and data. According to OECD (2016a), uncertainty and data content are central to mathematical analysis of various problem situations, the underlying probability and statistics, and methods of data representation. This area of mathematical literacy involves identifying differences in processes, having a sense of quantity of the differences, and accepting uncertainty and error in measurement about chance. Additionally, at the heart of uncertainty and data, forming, interpreting, and evaluating conclusions drawn in a variety of situations where uncertainty is central are important concepts.

Context. On the PISA mathematics survey, various contexts are used to ensure coverage of numerous students' interests and the variety of situations that students might be exposed to in society (OECD, 2016a). Four context categories taken into account on the assessments are personal, occupational, societal, and scientific (OECD, 2016a). The personal context involves problems that focus on activities of students, their families, and/or peers. Examples of personal contextual problems might include shopping, sports, and personal finance. The occupational context involves problems that are central to the work force. Some examples include measuring, pricing and ordering materials, designing a building, and scheduling an event. The societal context involves solving problems focused on students' communities at the local, national, or international levels. Examples of these type problems might include voting, transportation, demographics, and advertising. The scientific context involves problems relating to the application of mathematics to the natural world and information related to science and technology. Problems in this area might include weather, climate, ecology, and measurement. Please see Figure 2 for a visual of the content, context, and processes of mathematics tested on the PISA assessments (OECD, 2016a).

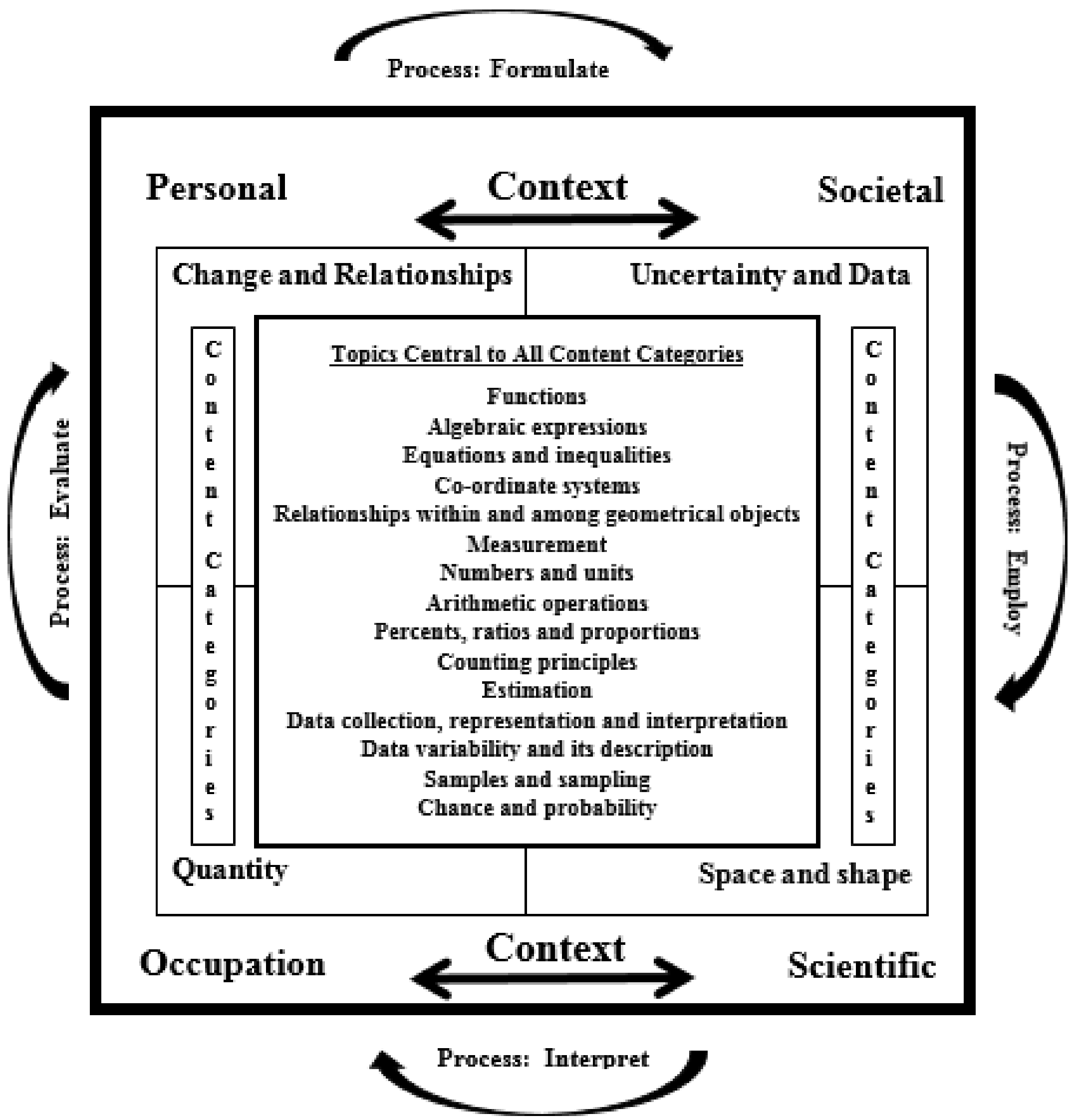

Figure 2. A visual of the content, context, and processes of mathematics tested on the PISA assessments. Adapted from "PISA 2015 Mathematics Framework" (In *PISA 2015 Assessment and analytical framework: Science, Reading, Mathematic and Financial Literacy*) by OECD Publishing, pp. 63-78. Copyright 2016 by Creative Commons licensed under NC-SA 3.0 IGO. (See Appendix B.)

The importance of mathematical literacy. In times past, individuals have been embarrassed about not being able to read (Baroody & Dower, 2003/2009; Zaslavsky, 1994); however, those same views have been the opposite about knowing mathematics

(Baroody & Dower, 2003/2009; Zaslavsky, 1994). The attitude usually portrayed is that not being able to know and to use mathematics is acceptable. This view on the unimportance of mathematics might be attributed to the fact that with the increased use of technology tools (e.g., smartphones, tablets, calculators) used to calculate mathematical situations that they experience in their everyday lives, some individuals believe that there is no need to know or to understand the underlying mathematics (Hodgen & Marks, 2013. However, this view point about mathematics is not held by many other individuals in the United States.

Change the Equation (2017), an organization that helps people and businesses realize their full potential utilized the services of Toluna to conduct a recent on-line national survey to gauge Americans' attitudes toward their mathematics skills. The on-line study involved 1,000 U.S. participants across the country who were at least 18 years or older. From the study researchers were able to conclude at a 95% confidence level that 29% of those surveyed admitted to not having adequate mathematics skills. Interestingly, 53% of the 18-24 years old age group were the most likely to report that that they have found themselves saying that they cannot do mathematics (Change the Equation, 2017). Overall, at least 90% of the participants surveyed recognized the importance of having good mathematics skills is essential to having a successful life and that the lack of emphasis on developing good math skills will have a negative impact on the future of the U.S. economy (Change the Equation, 2017).

Hodgen and Marks (2013), in their review of the literature of mathematical needs in the workplace, concluded that the mathematical content in use and applicable to workplaces include number, statistics and probability, algebra, geometry, and measurement. More importantly, they contended that workers must have skills in mental reasoning, approximation and estimation, the interpretation of graphs, and the use of spreadsheet and calculators. Hodgen and Marks advocated, “[Mathematics] competence matters in the workplace. The incorrect application or interpretation of mathematics can have significant economic or safety implications.” (p. 9)

Additionally, individuals working in specialized areas requiring mathematics are able to earn better pay and are more likely to be employed (Kena et al., 2016; Pay Scale Human Capital, 2017). According to the National Center for Education Statistics (NCES), Asian students graduating with a bachelor’s degree or higher in computer and mathematical fields earned $20,000 more per year compared to African American students not majoring in those particular fields of study (Kena et al., 2016). It was also noted within the same report that the average workers with at least a bachelor’s degree earn more and have lower rates of unemployment than do non-degreed workers (Kena et al., 2016). For students living in low socio-economic areas, Garland et al. (2011) concluded that when these students reached high achievement levels by participating in advanced courses in high school, earning Advanced Studies diplomas, and scoring advanced proficient on state assessments in reading, writing, and mathematics, they were more likely to enroll and to persist in post-secondary institutions. Hodgen and Marks (2013) also emphasized that for students of poverty to benefit from attending post-secondary institutions and to obtain higher paying jobs, might more than likely rely on their mathematical competence developed during their matriculation from Kindergarten through 12th Grade. Thus, knowing and being able to use mathematics is a high-stake skill for today’s job market. How are U.S. policy makers and educational leaders addressing the need to ensure that all students are equipped with mathematics competence? The answer to this question is addressed in the following section.

Addressing mathematical literacy in the United States. Policy makers around the world use PISA findings to measure the knowledge and skills of students in their own countries with students in other contributing countries. This comparison helps different countries establish benchmarks for aligning their educational systems to meet global standards to ensure their students are equipped to compete in a global work force. Additionally, policy makers and educational leaders use results from PISA to understand the relative strengths and weaknesses of their own education systems (OECD, 2016a). The United States has been no exception.

U.S. policy makers and educational leaders have recognized the need to improve the teaching and learning of mathematical literacy skills in the classroom (Wiseman, 2010). In a quest to reform mathematics education in schools, political and educational leaders in each state have been encouraged to realign their mathematics standards to those set forth by NCTM (2016a) and to re-design their state examinations to reflect more cognitive rigor. Moreover, the America Competes Act of 2007 passed by the 110th Congress and signed by the President George W. Bush on August 9, 2007 encompassed the Science, Technology, Engineering, and Mathematics (STEM) program implemented across the nation in many primary grades and continuing to the workplace in an effort to prepare students for these careers. Moreover, in 2011, under the guidance of the Council of Chief State School Officers (CCSSO) and the National Governors Association (NGA), common core state standards (CCSS) were established in mathematics and English language arts/literary (Common Core State Standards Initiative [CCSSI], 2011).

CCSS for mathematics. The CCSS standards for mathematics include content standards and mathematical processes outlining what students should know and be able to accomplish at the end of each grade level (CCSSI, 2011; NCTM, 2016b). These standards outline the skills and knowledge that all students need to thrive in college, career, and life, irrespective of where they live (NCTM, 2016b). In the United States, The Standards for Mathematical Practice involve the processes and proficiencies set forth by NCTM and NRC (CCSSI, 2011).

NCTM. NCTM (2016a) has identified the following five process standards: problem solving, reasoning and proof, communication, representation, and connections. These process standards are embedded in all mathematical content standards (i.e., number and operations, algebra, geometry, measurement, and data analysis and probability. State testing has been designed to measure students' understanding and application of mathematics content and mathematical processes. Chapter 3 provides a detail discussion on what students are tested on by each strand.

NRC. To capture the essence of what it means for anyone to learn mathematics successfully, NRC uses the term mathematical proficiency. Their holistic view also takes into account the skills individuals need in society to become productive, self-supporting citizens. NRC (2001) describes mathematical proficiency as comprising five strands: (a) conceptual understanding—involving comprehension of mathematical concepts, operations, and relations; (b) procedural fluency—being able to carry out procedures flexibly, accurately, efficiently, and appropriately; (c) strategic competencies—having the ability to formulate, represent, and solve mathematical problems; (d) adaptive reasoning—having the capacity for logical thought, reflection, explanation, and justification; and (e) productive disposition—seeing mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy.

Standards for mathematical practice. The Standards for Mathematical Practice delineates the various expertise that mathematics teachers at each grade level should strive to cultivate in their students. These standards also describe developmentally appropriate ways for mathematics teacher to engage students in the mathematics content. As previously mentioned, the mathematical standards of practice adopted by CCSSI (2011) rely on essential processes and proficiencies important to mathematics education. They also align with PISA's mathematical literacy. The Standards for Mathematical Practice are as follows:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning

In the United States, various entities connect students' capabilities in mathematical literacy to the teachers of mathematics. For example, researchers have documented that struggling learners have traditionally received little instruction in mathematics conceptual understanding (Helwig, Anderson, & Tindal, 2002; Pogrow, 2009; Shellard, 2004). If students are to become more mathematically literate or competent, teachers must be able to set learners up for successful mathematical experiences. As presented in this section of the literature review, mathematical literacy might appear as an overwhelming task to teach and to ensure mastery of skills by students with its many components and cognitive demands on the brain. No wonder training preparations and/or professional development designed to inform teachers of mathematics with research-based strategies and tools required to develop students' mathematical literacy skills as a whole, is viewed as needing improvement (Brophy & Good, 1974; Darling-Hammond, 2006; Darling-Hammond, Holtzman, Gatlin, & Heilig, 2005; Kuenzi, 2008; Shulman, 1987). According to Schmidt, Cogan, Houang, and McKnight (2009), it is not enough for teachers to know how to do mathematics, but they must receive specific instruction in the teaching of mathematics to diverse learners.

In light of this discussion on mathematical literacy and its importance in the job market, the current administration, President Trump, has threatened to eliminate all common core state standards. By doing so would lower the learning expectations of our students. If this course of action were to be implemented, it would be a tragedy to our educational system and detrimental in preparing our students for a global society. There might not be equal opportunity to learn [OTL] (Schmidt et al., 2009) for all students because some educational institutions might continue to provide students with high-end courses, whereas others institutions would provide students with basic courses. In either case, teachers make the difference.

Teachers' Effects

Effective teaching has not always been the targeted focus for helping students, especially minority students, achieve in school. The knowledge base on teaching and learning in the United States today has been a journey. Researchers from the fields of education, communication, psychology, sociology, and neuroscience have all contributed to the body of literature from the lens of their expertise. In the Equality of Educational Opportunity Study (EEOS) of 1966 conducted by Coleman et al. (1966), the authors reported that African American children in low socio-economic communities did better academically although not significantly in integrated, middle-class schools. Coleman et al. (1966) also documented that students who had knowledgeable teachers were more successfully academically than were those who did not. Jencks (1972) subsequently substantiated Coleman et al.'s findings with his study on Inequality: A Reassessment of the Effect of Family and Schooling in America. The findings reported by Coleman et al. (1966) and Jencks (1972) influenced decisions made by policy makers in addressing environmental settings where students were educated in hope of closing the achievement gap (Armor, 1972). This led to students living in low socio-economic areas being bussed or attending schools outside of their neighborhoods (Armor, 1972).

From the mid-70s to the mid-80s, trends in research studies conducted by researchers in the field of education, communication, psychology, sociology, and neurosciences shifted to teachers' behaviors and the effects that these behaviors had on student outcomes (Porter & Brophy, 1988). Although these studies were conducted using isolated teacher behaviors with limitations on internal and external factors (e.g., the context of the study, student characteristics, available resources), they collectively added to the body of literature (Brophy, 1986; Porter & Brophy, 1988), in contrast to the Indian folklore about six blind men and an elephant (Saxe, 1873). The folklore story is told about some blind men who had never experienced an elephant and set their course to find one. Upon encountering the elephant, in short, each man touched a different part of the elephant and assumed that was what the elephant was like (i.e., side—wall, tusk—spear, trunk—snake, knee—tree, ear—fan, and tail—rope). Keeping to their own subjective views, the men debated amongst themselves instead of embracing one another's perceptions to put all their knowledge together to experience the whole elephant.

From a review of the studies relating to teachers' effects on the learning outcomes of students, Brophy (1986) synthesized,

> …they [teachers] differ in several respects: the expectations and achievement objectives they hold for themselves, their classes, and individual students; how they select and design academic tasks; and how actively they instruct and communicate with students about academic tasks. Those who do these things successfully produce significantly more achievement than those who do not, but doing them successfully demands a blend of knowledge, energy, motivation, and communication, and decision-making skills. . . . (p. 1076)

Additionally, drawing from the body of literature, Glickman (1991) defined effective teaching as, "a set of decisions about the use of a variety of classroom materials and methods used to achieve certain learning goals" (p. 6). He added, "… what effective teachers do is constantly reflect about their work, observe whether students are learning or not, and then adjust their practices accordingly" (p. 6). Thus, effective teaching is those practices by teachers that influence positive learning outcomes for students.

Using a narrower focus, Nussbaum (1992) conducted a review of the literature from the fields of education and communication on studies from 1980 to 1992 linking teacher behaviors with teacher effects. Two major trends of thought emerged pertaining to teacher effects on student achievement (Nussbaum, 1992). One was teacher behaviors (e.g., teacher clarity, teachers' verbal behaviors, teacher immediacy). The other was teacher content knowledge and pedagogical knowledge (knowing the "what" to teach and the "how" to teach it). As a result of Nussbaum's (1992) review, he revealed researchers in both fields of study had identified similar teacher behaviors that were significant predictors of student achievement. Several teacher behaviors common in both fields of study were teachers' clarity, teachers' immediacy, and teachers' verbal behaviors (Nussbaum, 1992).

From the 1990's to present, educational research has been more integrated—controlling for and testing more than one variable at a time. R. Ferguson (2012) developed the Tripod Survey in 2001 to capture students' perceptions of their teachers. Tripod refers to content knowledge, pedagogic skills, and relationships (R. Ferguson, 2012). Since its inception in 2001, more than one million elementary, middle, and high school students in the United States have provided valuable information on their perceptions of their teachers' content knowledge, pedagogic skills, and relationships. The Tripod Survey covers seven areas: (a) care, (b) control, (c) clarify, (d) challenge, (e) captivate, (f) confer, and (g) consolidate that will be intertwined with the previous topics identified for discussion under teacher effects and social emotional learning. The Tripod Survey will be discussed in more detail in Chapter 3.

Teachers' content and pedagogical knowledge and self-efficacy. In the U.S. educational system, each state is responsible for providing their school districts educational objectives/standards for Grades Kindergarten–12th. These standards are referred to as the "what" to teach. However, the "how" to teach the "what" has often been the responsibility of the teachers. Researchers (e.g., Bandura, 1997; Henson, 2002; Mullis et al., 2009) have referred to teachers using their knowledge and creativity as the teachers' self-efficacy. Mullis et al. (2009) believed that teachers' self-efficacy is the teachers' sense of their personal abilities to organize and to execute their teaching. Moreover, Bandura (1997), who has been cited more than 50,000 times in articles and books regarding teachers' self-efficacy, advocated that teachers' self-confidence in their teaching skills is associated with their professional behavior and students' performance and motivation. Several researchers have concluded that teachers with positive beliefs in their abilities were more open and flexible to new ideas (Bandura, 1997; Henson, 2002; Mullis et al., 2009).

Over a 3-year period, Shulman (1987) observed novice and veteran teachers teaching some of the same content materials. He and his team sought to determine what kinds of knowledge and skills were necessary better to prepare in-service teachers for the classroom by observing the struggles that novice teachers had with teaching challenging concepts as opposed to the same concepts being taught with ease by veteran teachers (Shulman, 1987). In describing the knowledge base necessary for teachers to influence understanding of subject concepts among students, Shulman (1987) identified the following seven categories: (a) content knowledge; (b) general pedagogical knowledge—classroom management and procedures; (c) curriculum knowledge-teaching tools and resources; (d) pedagogical content knowledge—teaching strategies (e) knowledge of learner and their characteristics; (f) knowledge of educational contexts—classroom, school, district, and community; and (g) knowledge of educational goals. The teaching knowledge base might be acquired by teachers through scholarship of content discipline, educational materials and structures, scholarly literature, and wisdom of practice through self-reflection and evaluation (Shulman, 1987). Importantly, Shulman (1987) and other researchers have determined teachers' in-depth content knowledge, understanding of the structure of the discipline, and awareness of their dispositions of the subject matter being taught were central to the knowledge base of teaching (Darling-Hammond, 2006; Ertmer, 2003; Hill & Lubienski, 2007; Zimmerman, Bandura, Martinez-Pons, 1992; Porter & Brophy, 1988). Shulman (1987) believed that the knowledge-based foundation provided teachers the basis for decision-making and implementing their instructional plans that he described as pedagogical reasoning and action (Shulman (1987). According to Shulman (1987), "[G]iven a text, educational purposes, and/or a set of ideas, pedagogical reasoning and action involve a cycle through the activities of comprehension, transformation, instruction, evaluation, and reflection" (p. 14).

Comprehension. With comprehension, Shulman (1987) believed that teachers should understand the content that they were teaching and to be able to think critically about the content. He believed that they should know how the concept relates within and across disciplines. Additionally, Shulman (1987) held that teachers should understand how different concepts impact the purpose of the over-arching goal of education. For teachers of mathematics, Ball and Bass (2000) believed that being able to use mathematical knowledge involved teachers understanding mathematical concepts and having the ability to reason about subtle academic queries (e.g., how students might think, how a particular topic might evolve in the class, or the need for a new representation, explanation on a familiar topic).

However, Fernandez (2005) found in her study on mathematics teachers in Grades 2-5 that they lacked a deep enough understanding of the mathematics covered in their lessons to speculate on potential problems that students would have in understanding the teaching of the concept of fractions. This finding has been somewhat typical of U.S. teachers often knowing little about how best to teach particular concepts of mathematics and having difficulty delivering instruction that is responsive to the mathematical challenges that emerge when their students are asked to solve rich problems and share their thinking about them (Ball & Bass, 2000; Shellard, 2004). However, teachers having knowledge about what they teach continues with imparting their knowledge to students.

Transformation. Shulman (1987) admonished that teachers' comprehension was not enough. He claimed that teachers needed to know how to transform their content knowledge in ways students might be able to grasp that knowledge. He also indicated that teachers made and acted on decisions based on their comprehension of the learning concept being presented. Shulman's (1987) idea of the transformation processes included preparation, representation, instructional selections, and adaptation and tailoring. The processes are explained as follows:

1. Preparation involved teachers examining and critically interpreting the materials from their understanding of the academic concept.
2. Representation involved teachers thinking through key points of the lessons and finding various ways to present the information to students such as using role-playing, demonstrations, visuals, and examples.

3. Instructional selections involved teachers using various teaching strategies to teach students like cooperative learning, modeling, recitations, project-based learning, discovery and inquiry, and reciprocal teaching.
4. Adaptation and tailoring involved teachers modifying the lessons as they detected students' lack of understanding through their verbal and nonverbal behaviors. This also included teachers tailoring the lessons to meet students' needs such as motivation, prior knowledge, language acquisition, and cognitive abilities.

Instructional selections. Shulman (1987) thought of the activity of instruction as the physical act of teachers putting their instructional plans into action. Teachers were expected to interactively engage their students in lessons by using various and multiple instructional strategies to meet the needs of all learners. Possible strategies might have included teachers using humor, questioning, guided practice, modeling, multimedia presentations, group work, discovery and inquiry, and project-based learning that provide opportunities for students to be challenged at various levels (Kane & Staiger, 2010, 2012). Other teaching activities considered were managing the class, presenting clear explanations, and assigning and checking students' work. Shulman (1987) advised that flexible and interactive teaching methods might not be available to teachers when they lack the understanding of the concept to be taught.

Evaluation. Shulman (1987) asserted that the evaluation of students' learning happened throughout the teaching of a concept. Many teachers check for students' misunderstanding prior to a lesson using pre-tests to determine the knowledge level of students on a particular topic in order to adjust instruction. Teachers might also use quick checks like thumbs-up and thumbs-down, 1-2-3 cards, and shoulder partners to monitor students' understanding of the new material and make decisions to extend the instruction of the lesson or to assign independent/group work. To evaluate students' understanding, Shulman (1987) and other researchers (Darling-Hammond, 2006; Ertmer, 2003; R. Ferguson, 2012; Hill & Lubienski, 2007; Kane & Staiger, 2010, 2012; Porter & Brophy, 1988; Zimmerman et al., 1992) believed teachers must have in-depth knowledge about the objective to be taught and the processes of learning to help students consolidate or make connections in what they learned in class to the real world. Many teachers not only evaluate students' learning formally and informally, but they evaluate themselves. This self-evaluation is referred to as reflection.

Reflection. Often times, teachers engage in reflective practices to examine how effective they were in transforming knowledge in ways that students were able to grasp the learning concept. Teachers might consider what went well during the lesson delivery, what part of the lesson could be improved, or how they might better enrich the lesson for accelerated learners (Shulman, 1987). Teachers might reflect on their practices independently, using video-taping, or peer mentoring (Bill and Melinda Gates Foundation, 2013a; Ladson-Billings, 1990, 1995). Moreover, a number of educators confer with students by involving them in reflective practices as learners of the content presented, evaluators of the teaching strategies, and the assigned learning tasks utilized in the lesson of study (R. Ferguson, 2012; Kane & Staiger, 2010, 2012; Shulman, 1987). Porter and Brophy (1988) viewed teachers' self-reflection as a self-correction mechanism for future planning (Ladson-Billings, 1990, 1995)—thereby bringing about new learnings through reflective practices (Shulman, 1987).

New comprehensions. According to Shulman (1987), it is expected through "acts of teaching" (p. 19) where decisions have been made and implemented based on the teachers' knowledge base of the content, that new comprehension or learning takes place. However, he contended that this new learning was not automatic (Shulman, 1987). Specific methods for tracking documentation, analyzing achievement of lesson goals, and discussions of the data were required (Shulman, 1987). In Figure 3, Porter and Brophy have highlighted a model of good teaching that outlines factors influencing teachers' instructional practices of academic content.

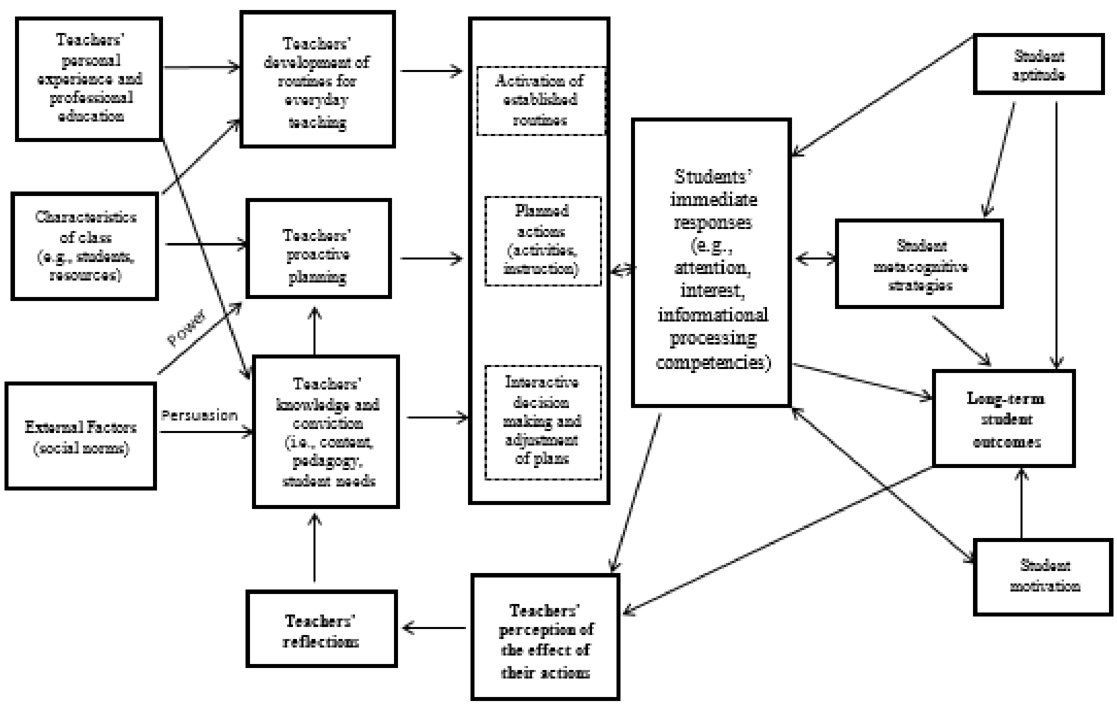

Figure 3. Model of factors influencing teachers' instruction of their students in particular content. "Synthesis of Research on Good Teaching: Insights from the Work of the Institute for Research on Teaching," by A. C. Porter, and J. E. Brophy, 1988, *Educational Leadership*, *45*(8), p. 74. Copyright 1988 by ASCD. Reprinted with permission. (See Appendix C.)

Effective teacher behaviors. Teachers have unique qualities, backgrounds, beliefs, and interests that make them who they are (Brophy & Good, 1970; Cai, 2005; Caine & Caine, 2011; Porter & Brophy, 1988; A. Thompson, 1984). They have different ways of maneuvering students' behaviors, planning and delivering lesson content, and making decisions throughout the school day (Brophy, 1986; R. Ferguson, 2012; Kane & Staiger, 2010, 2012; Glickman, 1991; Porter & Brophy, 1988). Effective teachers' behaviors addressed will be clarity and immediacy—nonverbal and verbal behaviors. However, focusing on these teachers' behaviors in no way minimizes the influence of other factors (e.g., beliefs and values) pertaining to the individuality of teachers.

Teacher clarity. The single most important factor concerning students' academic achievement, motivation, and attitudes about learning is the teacher. Thus, teacher clarity is an essential behavior that drives the learning process and classroom management systems. Chesebro, in his unpublished manuscript (as cited in Chesebro & McCroskey, 2001), thought of teacher clarity as a way that teachers disseminate subject area content using verbal and nonverbal messages to engage students in the learning process. Although Chesebro's initial perspective of teacher clarity was vague, later Chesebro and McCroskey (2001) provided a more detailed constitution of teacher clarity: "To be clear, teachers need to make their organization of content explicit so students are able to integrate lecture material into their schemata effectively. Clear teachers also speak fluently, stay on task, and explain information effectively" (p. 62). To show what behaviors are used by teachers to help students during the learning process, Houser and Frymier (2009) explained, "When teachers are clear, they do things like use previews and summaries, they stress important points, use visual aids, and help students prepare for assignments" (pp. 48-49).

Chesebro and McCroskey (2001) focused on receiver apprehension, a term used by Wheeless (1975) to describe the fear that individuals have in their abilities to understand, to process, or to react to messages sent by the senders. Thus, based on the review of the literature more time being spent receiving messages, and dependent upon how those messages are sent, could possibly cause the receiver to have anxiety, Chesebro and McCroskey (2001) deemed receiver apprehension to be a "significant classroom problem" (p. 60), worthy of investigation. These researchers studied the relationships among receiver apprehension, teacher clarity, and teacher immediacy in the instructional context. The participants were 360 students enrolled in various courses from a large Mid-Atlantic University. Chesebro and McCroskey (2001) used several instruments having high score reliabilities (> .8) in their study to measure the effects amongst the variables involving state receiver apprehension, student motivation, student affect, cognitive learning, teacher nonverbal immediacy, and teacher clarity (see Table 5). Initially, the students responded to questionnaires about their learning and preferences as students. Afterwards, the students were asked to respond to survey items based on their previous instructors. Pertaining to teacher clarity, the researchers concluded that students of clear teachers were more likely to be motivated, have positive affect for their instructor and the course, and were likely to perceive that they had learned more cognitively. Chesebro and McCroskey (2001) also determined that students having clear teachers were less likely to report experiencing anxiety when listening to classroom messages.

Table 5

Instruments used by Chesebro and McCroskey (2001) to Measure the Relationship of Teacher Clarity and Immediacy with Student State Receiver Apprehension, Affect, and Cognitive Learning

Instrument	Instrument Description	Reliability Alpha
State Receiver Apprehension	A-State anxiety measure by *Spielberger, Gorsuch, and Lushene (1968), a 5-item Likert-type scale used to measure individuals' sensitivity to anxiety produced by a specific stimulus assess—the extent to which students tend to feel anxiety when learning from specific teachers.	.92
Student Motivation	Christophel's (1990) 12-item motivation instrument, a semantic differential scale consisting of adjectives like interested-uninterested, involved-uninvolved; excited-not excited, challenged-unchallenged; unenthused-enthused; and uninspired-inspired.	.94
Student Affect	The Instructional Affect Assessment Instrument (TIAAI) by McCroskey (1994) consisting of four items measuring students' evaluation of their teachers and four items for addressing affect toward the subject matter of the course.	Instructor—.94 Affect toward course subject matter—.92
Cognitive Learning	Learning loss developed by Richmond, McCroskey, Kearney, & Plax (1987) measuring the difference in students' self-reports about how much they perceived they learned from their teachers and how much they could have learned the same material had they been taught by the ideal teachers.	No reliability estimate—data collected one point in time; however, previous studies of test-retest reliability were noted as being high (> .8)

(continued)

Instrument	Instrument Description	Reliability Alpha
Teacher Nonverbal Immediacy	Revised version of the Perceived Nonverbal Immediacy Scale (PNIS) by *Thomas, Richmond, and McCroskey (1994) consisting of 10 low-inference survey items formatted as a five-step response scale with answer choices ranging from never to very often measuring teachers' behavior involving eye contact, the use of gestures, movement about the classroom, smiling, vocal variety, and the use of humor.	.86
Teacher Clarity	Teacher Clarity Short Inventory (TCSI) by *Chesebro and McCroskey (1998) consisting of 10-item scale of Likert-type items involving low-inference items and items related both to oral and written content and process clarity.	.92

Note. Displayed content from "The Relationship of Teacher Clarity and Immediacy with Student State Receiver Apprehension, Affect, and Cognitive Learning" by J. L. Chesebro, and J. C. McCroskey, 2001, *Communication Education, 50*, pp. 59-68. Copyright 2017 by Copyright Clearance Center on behalf of Taylor and Francis. (See Appendix D.)

In a similar study, Comadena, Hunt, and Simonds (2007) investigated the effects of teacher clarity, teacher immediacy, and teacher caring on students' motivation and affective and cognitive learning. These researchers also used undergraduate students as participants in their study. Their study population comprised 233 students enrolled in a freshman-level communication skills course in a large Midwestern university (Comadena et al., 2007). Participants were provided descriptions of hypothetical teachers who were described as being either low or high in nonverbal immediacy, teacher clarity, and teacher caring. Afterwards, the participants completed questionnaires based on each of the teachers' behaviors previously mentioned. Student participants were asked to respond to the questions by imagining themselves as being a student in the instructor's class described in the questionnaire. In measuring student motivation and cognitive learning, these researchers used the same instruments as did Chesebro and McCroskey (2001) in the previous mentioned study (see Table 4). Additionally, the researchers employed manipulation checkpoints to assess for teacher clarity, teacher immediacy, and teacher caring. To check teacher clarity, participants responded to the question, "How clear was the teacher you had in mind?" (Comadena et al., 2007, p. 244) using seven-point semantic differential scales composed of items, such as, not all clear/very clear and understandable/not understandable. To check immediacy, researchers told the participants that instructors who were immediate displayed patterns of nonverbal behavior such as "gaze, smiling, gestures, and vocal animations" (Comadena et al., 2007, p. 244) and were perceived to be "physically or psychologically close to students" (Comadena et al., 2007, p. 244). The researchers used three semantic differential scales consisting of not immediate/immediate, close/distant, and approachable/unapproachable. To check teacher caring, participants were told by the researchers that caring teachers were "responsive to their students' needs and was concerned about their well-being" (Comadena et al., 2007, p. 244). The researchers used 2-point semantic differential scales consisting of very concerned about students/not concerned about students and uncaring/caring. Overall, the score reliability for each of the instruments that Comadena et al. (2007) used in their investigation was high (> .90 or higher). From the results of the study, the researchers observed that teacher clarity had a moderate effect on all of the dependent variables: (a) cognitive learning (Effect size [ES] = .54); (b) motivation (ES = .53); and (c) affective learning (ES = .48). Thus, Comadena et al. (2001) were able to conclude, like Chesebro and McCroskey (2001) that teacher clarity behaviors were an important factor of students' cognitive learning, motivation, and affective learning. Additionally, Comadena et al. (2001) determined that teacher nonverbal behaviors influenced student motivation and affective learning.

In another study consisting of 497 ninth-grade students, Mottet et al. (2008) confirmed that teacher clarity coupled with content relevance behaviors predicted students' desire to enroll in additional mathematics and science courses and to consider careers in the fields of mathematics and science. The researchers examined how students' perceptions of their teachers' instructional communication behaviors (i.e., teacher nonverbal immediacy, teacher clarity, teacher content relevance, and teacher disconfirmation) were related to the students' affective learning in mathematics/science (i.e., interest in enrolling in mathematics/science courses in post-secondary schools and engaging in mathematics/science careers) and student study strategies (Mottet et al., 2008). Interestingly, Mottet et al. (2008) also observed from their findings that students' perceptions of their mathematics/science teachers' use of nonverbal immediacy, clarity, and content relevance was significantly more negative than of other teachers not teaching mathematics/science (i.e. English Language Arts).

Other researchers like Houser and Frymier (2009) examined learner empowerment. They conducted an investigation to examine the role of student characteristics (i.e., temperament, learner orientation) on empowerment along with the impact of instructors' communication behaviors (i.e., nonverbal immediacy, clarity). These researchers obtained surveyed responses of 397 university students enrolled in introductory communication courses in both a Midwestern and a Southwestern university in the United States. Similar to the findings of other researchers, Mottet et al. (2008) also determined that teacher clarity was the primary predictor of student empowerment and learning. However, Houser and Frymier (2009) also determined from their study that both clarity and immediacy influenced students' perceptions of their influence in the classroom. The researchers believed that with clear, approachable teachers, students feel more capable to make sense of the academic content, apply their knowledge to complete assignments, and to share their connections of that knowledge across other areas of interest regardless of learners' orientations. Thus, when immediacy is present, the teacher-student relationship is strengthened (Bronfenbrenner, 1977/2009; Gorham, 1988; Mehrabian, 1969; Mottet et al., 2008).

Teacher immediacy. Oftentimes, we as human beings tend to make judgements about other people. Some thoughts that we might have could pertain to how they look, to how they talk, to how they act, or to their social status. Within the walls of the classrooms, teachers and students are no different—teachers possibly perceiving students' body language and attitudes toward instruction and assignments as interested or not motivated and students possibly perceiving teachers as knowledgeable or unfriendly (Brophy & Good, 1970, 1974). According to Brophy and Good (1974), teacher-student interaction is a "two-way process" (p. 12). They believed that students influence teachers' behavior as much or more than do the teachers influence students' behavior (Brophy & Good, 1974). We as humans assign levels of importance as we perceive someone or something to be. This act is known as "immediacy." According to the Miriam-Webster Dictionary (YEAR?), immediacy has been used to mean "the quality that makes something seem important..." Mehrabian (1969), a researcher in the field of sociology noted for his work with immediacy and cited in more than 10,000 articles and books by other researchers, defined immediacy "as the extent to which communication behaviors enhance closeness to and nonverbal interaction with another" (p. 203). Comadena et al. (2007) described teacher immediacy as, "behaviors that signal a reduced physical and psychological distance between student and instructor" (p. 241). What are those behaviors that teachers communicate to students that show they value and respect all students? As teachers interact with students in a positive, supportive manner, the expectation is held that students would reciprocate those same behaviors toward their teachers and other individuals in various settings (Bronfenbrenner, 1977/2009). Immediacy, an important factor of a productive learning environment (Chesebro & McCroskey, 2001; Christophel, 1990; Comadena et al., 2007; Frymier, Shulman, & Houser, 1996; Houser & Frymier, 2009; Mottet et al., 2008; Walker & McCoy, 1997/2013) consist of two components—nonverbal behaviors and verbal behaviors (Gorham, 1988; Mehrabian, 1969).

Teachers' nonverbal immediacy. Our body actions can speak to people just as powerfully as the words that we speak. Our first impressions of individuals are usually how we perceive their body language and their physical appearance. Mehrabian (1969) categorized nonverbal immediacy into five categories from the most impactful to the least impactful in student cognitive learning and affective learning. The first category, labeled immediacy cues, focused on attentive behaviors such as appropriate touching, proximal distances, forward leaning, eye contact, and body orientation. The second category, labeled relaxation cues, is used today in stress management and nonviolent crisis prevention and intervention management. Some teachers working with students might need to appear non-threatening to prevent or diffuse an emotionally charged situation.

The relaxation cues focused on arm position, sideways lean, hand relaxation, neck relaxation, and reclining angle. For example, an individual with arms held down along the sides of the body, hands dangling, and standing at an angle could appear to be non-threating, whereas an individual with hands clenched, and direct stance could be negatively perceived as threatening or having power. Moreover, sitting in a reclined position with head held back could appear as being calm and peaceful. The third category, labeled movement, focused on how we move our bodies. These movements included trunk swivel movements, rocking movements, head nodding movements, gesticulation, self-manipulation, leg movement, and foot movement. In some form or fashion, many individuals, whether aware or unaware, tend to incorporate some type of movement while communicating. For example, it is common for some individuals to move their hands as they speak, to place their fingers on their head when they are seriously thinking, or to stamp their feet to show frustration. The fourth category, labeled facial expressions, focused on facial pleasantness and facial activity. Our brains are hard-wired for six kinds of emotions—sadness, joy, disgust, anger, surprise, and fear (Jensen, 2009). Furthermore, some individuals are good at hiding their feelings whereas the faces of others portray their inner-feelings. The fifth category, labeled verbalization, focused on communication length (duration), speech rate (number of words per minute), halting quality of speech (variability of speech rate and quality-stammering, radio announcer), speech error rate (repetition, sentence incompletion, sentence change, stutter, tongue slips, and intruding incoherent sounds), speech volume, and intonation (pitch). Some teachers might not be able to hold students' interest if the teachers' speech is not clear due to stuttering because some students might have to use excessive energy to decipher the words spoken by the teachers. Sometimes teachers might speak at a faster rate than students who have low processing speeds can understand. Still other teachers might speak in a high-pitched tone that might be annoying to students with sensitivity to sounds at a certain level. In Mehrabian's (1969) work with nonverbal immediacy, he identified the nonverbal behaviors by the communicators that influenced attitudes, potency, and responsiveness of the receivers. They were as follows:

1. Nonverbal behaviors by the communicator that influenced more positive attitudes of the receivers were a) immediate cues—touching proximal distances, forward leaning, eye contact body and orientation; (b) movement—higher rates of gesticulation and positive head nods; (c) positive facial expressions; and (d) verbalization—longer communications, higher speech rates, lower rates of speech disturbance, and less halting quality of speech.
2. Nonverbal behaviors by the communicator that influenced potency, social status, or dominance to the receivers were (a) relaxed cues—arm position, sideways lean, hand relaxation, neck relaxation, and reclining angle; (b) movement—higher rates of rocking and gesticulation and lower rates of trunk swivel, higher rates of leg and foot movement and lower rates of self-manipulation, and lower rates of head nodding; (c) less facial pleasantness; and (d) verbalization—more speech volume, longer communications, and higher speech rates.
3. Nonverbal behaviors by the communicator that influenced the responsiveness of the receivers were (a) higher rates of facial activity and (b) verbalization—more speech volume and intonation.

Furthermore, other researchers investigating the influence of immediacy on students' attitudes and cognitive learning have observed that classrooms teachers captivated students' attention, conferred with students on matters pertaining to the class, and were immediate with students (Comadena et al., 2007; R. Ferguson, 2012; Frymier et al., 1996; Houser & Frymier, 2009; Kane & Staiger, 2010, 2012). The researchers also observed students as having more influence in the classroom with teachers who were immediate (Comadena et al., 2007; Frymier et al., 1996; Houser & Frymier, 2009). Researchers (Berry, 2005; Chesebro & McCroskey, 2001; Christophel, 1990; Comadena et al., 2007; R. Ferguson, 2012; Frymier, et al., 1996; Houser & Frymier, 2009; Kane & Staiger, 2010, 2012; Ladson-Billings, 1995; Mottet et al., 2008; Walker & McCoy, 1997/2013) have also reported students feeling more empowered or competent to perform learning tasks that were meaningful and relevant to their needs and interests. In addition to nonverbal behavior influencing students' cognitive and affective learning, verbal immediacy also has been found to impact increased students' learning (Gorham, 1988).

Teachers' verbal immediacy. Gorham (1988), in her study on immediacy, investigated students' perceptions of teachers' verbal immediacy behaviors individually and collectively that were associated with students' learning. She also replicated the research work of Chesebro and McCroskey (2001) on students' perceptions of the influence of their teachers' nonverbal immediacy on the students' affective and cognitive learning. Like other studies, college students were used in Gorham's (1988) study because these students could best describe their learning experiences as they had matriculated through school (Gorham, 1988). A total of 387 students participated in the study. Gorham (1988) concluded that students' perceptions of teachers' immediacy behaviors were influenced by verbal and nonverbal behaviors, and both contributed significantly to students' learning. Specific teachers' verbal behaviors identified by Gorham (1988) as being important to students were:

1. Using humor
2. Praising students' work, actions, or comments
3. Frequency of initiating and/or willingness to become engaged in conversations with students before, after, or outside of class
4. Disclosing personal information about experiences
5. Asking questions or encouraging students to talk
6. Asking questions that required students' opinions
7. Following up on student-initiated topics
8. Making references to classes using "we" and "our"
9. Providing feedback on students' work
10. Soliciting students' feeling about assignments, due dates, or discussion topics
11. Extending time to students beyond the school day

Based on Gorham's (1988) findings, teachers' verbal immediacy behaviors influenced students' perceptions of the affective and cognitive learning, although not as much as did teachers' nonverbal immediacy behaviors (Christophel, 1990). Other researchers investigating teachers' immediacy behaviors combined variables of both verbal and nonverbal immediacy in their studies (e.g., responding to students in a timely fashion, eye contact, smile, use of proximity, praise, humor) and used the term "immediacy" (Chesebro & McCroskey, 2001; Christophel, 1990; Comadena et al., 2007; Frymier et al., 1996; Houser & Frymier, 2009; Mottet et al., 2008; Walker & McCoy, 1997/2013). Furthermore, Sanders and Wiseman (1990) extended the work of previous researchers involving teachers' immediacy behaviors to the multicultural classroom. The participants were 952 White, Asian, Hispanic, and Black college students. Sanders and Wiseman (1990) also used the combined immediacy scale to determine the extent of students' perceptions of their teachers' immediacy behaviors influencing the students' cognitive learning, attitudes, and behavioral intent (likelihood of enrolling in another course taught by the same instructor). From the results of their findings, teachers' immediacy behaviors positively correlated with cognitive learning, affective learning, and behavioral learning for all ethnic groups, although there were some variances. (Sanders and Wiseman, 1990). For example, immediate behaviors related to students' perceived cognitive learning were: (a) encourages student discussions; (b) uses humor; (c) has discussions with students outside class; (d) seeks different opinions; (e) gives praise to students' work; (f) is not monotone; and (g) smiles (Sanders & Wiseman, 1990). However, specific immediacy behaviors unrelated to Black students' perceived cognitive learning included maintaining eye contact, discussing student-selected topics, and suggesting students telephone the teacher (Sanders & Wiseman, 1990).

Similarly, teachers' immediate behaviors on students' perceptions or attitudes varied among the ethnic groups. Those teachers' immediacy behaviors relating to positive perceived students' perception of affective learning were the same as those identified for cognitive learning with the exception of using a monotone voice. Concerning Black students, it was again observed that these students did not relate immediacy behaviors such as discussing students' topics and having discussions with teachers beyond the class to influencing their perceptions of affective learning. Nor did calling Black students by name impact their affective learning (Sanders & Wiseman, 1990).

Although students' perceptions of behavioral learning positively related to teacher's immediacy behaviors, there were only two behaviors related to all ethnic groups. Those behaviors were using students' names and maintaining eye contact with students. Of particular importance, Sanders and Wiseman (1990) concluded that Black students more so than did any other ethnic group perceived a stronger relationship relating to their perceptions of behavioral intent and teachers' immediacy behaviors when the teachers used humor and displayed a relaxed body positon. This finding pertaining to Black students might be explained by the fact that many students who live in low socio-economic environments might likely be exposed to stressful environments and have less tolerance to stress (Jensen, 2009). Many Black students live in such communities where they have to stay on guard and teachers who model stressful behaviors might influence students' behaviors (Bronfenbrenner, 1977/2009). Additionally, a number of studies conducted by researchers have shown there is a disproportionate number of discipline referrals for Black students in schools than for any other ethnic group. According to A. Ferguson (2001),

> African American boys are not accorded the masculine dispensation of being naturally 'naughty.' Instead, the school reads their expression and display of masculine naughtiness as a sign of an inherent injudicious, insubordinate nature that is a threat to order that must be controlled. Consequently, school adults view any display of masculine mettle on the part of these boys, through body language or verbal rejoinders, as a sign of insubordination. (p. 86)

While verbal and nonverbal immediacy were shown to influence students' perceptions of their affective and cognitive learning, other researchers believed that teacher immediacy, along with teacher clarity, are both necessary in teaching students. Chesebro and McCroskey (2001) contended that both clarity and immediacy combined together are important in the instructional process. The incorporation of immediacy might capture students' attention, but without clarity, the students might not understand the course content (Chesebro & McCroskey, 2001). The researchers also pointed out that clear teaching without immediacy behaviors might likely go unnoticed by many students because they might not be enthusiastic to pay attention, which might diminish the effectiveness of clear teaching (Chesebro & McCroskey, 2001).

Interestingly, Mottet et al.'s (2008) work in studying communication predictors of ninth-grade students' affective learning in mathematics and science led to the findings that students perceived mathematics/science teachers as using significantly less nonverbal immediacy, clarity, and content relevance behaviors than did the non-mathematics/science teachers. Mottet et al. also noted that there were significantly more disconfirmation (e.g., criticism, put-downs, and impatience) behaviors among mathematics/science teachers compared to other teachers (Mottet et al., 2008). Teachers' behaviors such as these might be viewed as a contributing factor of students' inabilities to learn mathematics and to find it enjoyable to pursue higher level courses or career choices in mathematics because students might be apprehensive (Chesebro & McCroskey, 2001; Frymier et al., 1996; Houser & Frymier, 2009) and feel distant from their teachers (Gorham, 1988; Mehrabian, 1969; Sanders & Wiseman, 1990). Furthermore, Freire (2000) argued that without dialogue between students and teachers, there can be no educating of students because dialogue in its true sense requires critical thinking, “the continuing transformation of reality” (p. 92).

While clarity and teacher immediacy behaviors significantly influence students’ cognitive and affective learning, their content and pedagogical knowledge are pre-requisites to disseminating information to students. In fact, although mentioned previously, content and pedagogical knowledge that teachers possess influence their attitudes and behaviors within the classroom (Bandura, 1997; Henson, 2002; Mullis et al., 2009). Teachers who understand the content tend to feel more confident about teaching than do those who find the content challenging (Brophy & Good, 1974; Darling-Hammond, 2006; Darling-Hammond et al., 2005; Kuenzi, 2008; Shulman, 1987). Whatever the case, the emotions or feelings evoked by teachers might be manifested through their behaviors during the course of instruction that directly affects the achievement of students.

Social and Emotional Learning

The teaching of mathematics involves a number of higher order thinking skills that require application across various settings (OECD, 2016a). Teachers have to be knowledgeable about the mathematics content that they teach and have a repertoire of strategies in communicating mathematical learning objectives to diverse learners (Brophy & Good, 1970, 1974; Darling-Hammond, 2006; Darling-Hammond et al., 2005; Kuenzi, 2008; Ridlon, 2009; Schmidt et al., 2009; Shulman, 1987). Additionally, when teachers have utilized all of their known teacher tools and strategies, they might experience the joys and/or frustrations of students learning or not learning taught concepts. In either case, teachers not only have to deal with their own emotions, but also the emotions of their students and the behaviors that stem from such emotions during the learning process (Jones, Bouffard, & Weissbourd, 2013; Pekrun, 2014). In the views of Caine and Caine (2011), emotions are a part of everything we do—our thoughts, emotions, and movements all interact. The researchers believe that the emotions of students are more developed than are their intellectual understanding and care must be given to students to protect their emotions (Caine & Caine, 2011). Likewise, Pekrun (2014), well known for his research on the development of achievement emotions in children and adolescents across genders and cultures, has pointed out that within the walls of the classroom, emotions are unavoidable and teachers should be on the watch to maximize learning for all students. According to Pekrun (2014),

> Emotions control the students' attention, influence their motivation to learn, modify the choice of learning strategies, and affect their self-regulation of learning. Furthermore, emotions are part of students' identity, and they affect personality development, psychological health and physical health. From an educational perspective, emotions are important because of their influence on learning and development, but students' emotional well-being should also be regarded as an educational goal that is important. (p. 6)

While teaching, it is necessary for teachers to be cognizant of their own emotions, to manage them, and to know how their emotions influence students' learning and behaviors (Caine & Caine, 2011; Jennings & Greenberg, 2009; Jones et al., 2013; Pekrun, 2014; Roeser, Skinner, Beers, & Jennings, 2012; Sylwester, 1995). Like parents, teachers similarly serve as role models. The way that teachers respond and react in various situations are communicated directly to students (Bronfenbrenner, 1977/2009;

Jennings & Greenberg, 2009; Roeser et al., 2012). However, if teachers are unaware and have difficulty managing their own emotions within the classroom, what behavioral messages are they sending to students? Like Bronfenbrenner (1977/2009), Sylwester (1995) warned educators that their impact on students might not manifest itself through the students on a daily basis, but it does become a part of the "ecology" (p. 140) of students' lives. In the United States, approximately two thirds of students in Grades 5-12 thrive in having a sense of well-being in that they feel positive about themselves and experience positive relationships with others (Lopez, 2010). What does this mean for the remaining one third of Grades 5-12 students who do not have a sense of well-being? Social and emotional learning should be addressed.

Emotions in the classroom. Students experience an array of emotions, such as happiness, sadness, frustration, surprise, and disappointment (Caine & Caine, 2011; Jensen, 2009; Jones et al., 2013). Stemming from situations (e.g., diet and physical health, fatigue, emotional health, and environmental factors) occurring outside the classroom or during the learning process, emotions might impede students' abilities to focus on learning. Needless to say, these factors must be addressed by the teacher to maximize students' learning. In the words of Dodge (1991) ". . . all information processing is emotional, in that emotion is the energy that drives, organizes, amplifies, and attenuates cognitive activity and in turn is the experience and expression of this activity" (p. 159). Caine and Caine (2011) surmised that situations—positive or negative—can affect students' levels of patience, quality of thinking, and mental focus.

Pekrun (2014) developed 10 guiding principles for educators to know when to consider students' emotions and behaviors to provoke positive emotions. They comprise:

(a) understanding emotions; (b) individual and cultural differences; (c) positive emotions and learning; (d) negative emotions and learning; (e) self-confidence, task value, and emotions; (f) emotion regulation; (g) classroom instruction and teacher emotions; (h) goal structures and achievement standards; (i) test-taking and feedback; and (j) family, peers, and school reform. Each of these guiding principles is discussed in the following sections.

Understanding emotions. The planning for and controlling of emotions is one half of the battle of teaching (Caine & Caine, 2011; Collaborative for Academic, Social, and Emotional Learning [CASEL], 2003; Jensen, 2009). In understanding emotions, Pekrun (2014) has identified four groups of academic emotions that influence learning. They are achievement emotions, epistemic emotions, topic emotions, and social emotions. Achievement emotions are concerned with how students feel about the successful completion of assignments and their grades resulting from the assignments. Epistemic emotions are emotions caused by cognitive problems like confusion and frustration when students are learning new, non-routine tasks. Topic emotions relate to the topics presented in the lessons and stimulate students' interest in learning materials. For instance, students might be asked to identify the mood in a selection, share feelings about a particular song, or show empathy toward a character. Social emotions relate to how teachers and students interact with one another in the classroom. Researchers tell us that our brains are wired for socializing (Caine & Caine, 2011; Jensen, 2005; Levine, 2002). Building trustful relationships with students where they have an avenue to share their emotions (e.g., love, sympathy, compassion, admiration, envy, anger, or social anxiety) is key (Caine & Caine, 2011; Jensen, 2009; Pekrun, 2014).

Individual and cultural differences. As individuals, we are all unique, and that uniqueness renders our emotions to be subjective. In the same situation, individuals can experience different emotions. For instance, one student might love learning mathematics and another student might experience high levels of anxiety when being taught mathematical concepts. These differences might be attributed to culture, ethnicity, gender, school membership, and class membership. What is key is that the differences in emotions experienced by different students within one culture are larger than the difference among cultures (Pekrun, 2014). Likewise, the differences among female students and the differences among male students are larger than the differences between the two genders. Due to individual differences, stereotyping students should be avoided. Pekrun (2014) advises that educators should make use of individual students' emotional reactions by identifying specific assignments/activities that evoke positive emotions and help students to build capacity for experiencing positive emotions by recognizing their specific emotional strengths.

Positive emotions and learning. Positive emotions are emotions that relate to pleasant and fun experiences. Emotions like enjoyment, excitement, hope, and pride are stimulators of positive emotions. When students enjoy learning, the assignments are the object of the emotions (Caine & Caine, 2011; Pekrun, 2014). Thus, students are more motivated and likely to attend fully to the task thereby allowing for a deeper understanding of the concepts when positive emotions are associated with the tasks (Caine & Caine, 2011; CASEL, 2003; Chesebro & McCroskey, 2001; Frymier et al., 1996; Houser & Frymier, 2009). Additionally, when students are motivated, they have a closer relationship with their teachers (Gorham, 1988; Mehrabian, 1969; Sanders &

Wiseman, 1990). Moreover, activation of positive emotions enhances students' flexible thinking and acting, as well as promotes students' self-regulation of their learning (Caine & Caine, 2011; Deci, Eghrari, Patrick, & Leone, 1994; Gagné & Deci, 2005).

Negative emotions and learning. Although negative emotions affect students' attention, motivation, use of learning strategies, and self-regulation of learning, they sometimes have the reverse effect of positive emotions. Negative emotions (e.g., anxiety, anger, shame) might arise from various situations where students feel inadequate in the learning process. Negative emotions draw students' attention away from learning because students tend to use their cognitive resources focusing on the emotion and not on the assigned task (Caine & Caine, 2011; Jensen, 2009; Pekrun, 2014). However, students experiencing negative emotions, such as confusion, might have positive outcomes because they are challenged to utilize their problem solving skills to arrive at the expected/unexpected solution (Pekrun, 2014). Whatever the situation, in knowing the unique differences of students and planning for those differences, the frequency of the negative emotions experienced by students within the classroom setting is likely to be minimized. Also helping students to use their negative emotions productively can enhance their learning outcomes. One way is to raise students' confidence in their abilities to solve problems, to focus their goals on mastering the learning materials, and to regard students' errors as new opportunities to learn rather than as personal failures (Pekrun, 2014).

Self-confidence, task values, and emotions. According to some researchers, emotions stem from many individual factors, including genetic make-up, physiological processes, early learning experiences, personal values, and cognitive appraisals of one's ability (Caine & Caine, 2011; Jensen, 2009; Pekrun, 2014). Having self-confidence involves students holding positive perceptions of their abilities to solve academic tasks and an overall sense of being able to learn and to succeed. Additionally, students also need to have a sense of being responsible for failure (Pekrun, 2014). Focusing on students' strengths in overcoming challenging areas reduces the tendency for students to develop learned helplessness. Moreover, students' emotions rely on their task values. Lessons that are fun and relevant to the daily lives of students are perceived as interesting and valuable. Helping students make connections across academic subjects and settings in the real world supports their self-confidence, the value of learning (Caine & Caine, 2011; Frymier et al., 1996; Hughes & Acedo, 2016), and consolidating information (R. Ferguson, 2012).

Emotion regulation. As individuals, we have different ways of handling our emotions. Presented in the same situation, based on our previous experiences and environments, our reactions might vary. For example, in looking at a glass of water, some people might display positive emotions about the glass being half-empty whereas other people might experience negative emotions about the glass being half-full. According to Blumer (1980), emotions run high within the classroom setting. Oftentimes students come to school with limited knowledge and resources in how to manage their emotions, resulting in unacceptable behaviors stemming from their emotions (Caine & Caine, 2011). Additionally, teachers' reactions to those students' behaviors also might vary, resulting in escalation or de-escalation of the situation. In emotional intelligence, individuals are expected to recognize, make use of, and regulate their own emotions, and the emotions of other people. Researchers (Caine & Caine, 2011; Jensen, 2009; Pekrun,

2014) believe that teachers can help students regulate their emotions by having students self-assess their emotional reactions and develop competence in managing their emotions by providing the students with multiple ways of approaching present and future situations.

Pekrun (2014) also has four types of regulations that teachers can use to assist students with regulating their emotions. The first type of regulation is emotion-oriented regulation that directly targets the emotion and involves the use of relaxation techniques such as taking 10 deep breaths before responding to a situation. The second type of regulation is appraisal-oriented regulation that involves changing the self-assessments encouraging the emotion by having students develop a higher regard for themselves. The next type of regulation is the competence-oriented regulation that encompasses increasing students' competencies or skill sets, thereby promoting positive emotions that result from effective actions and reducing negative emotions. The final regulation is situation-oriented regulation that involves selecting or changing environments in ways that modify students' emotions. For example, when students are beginning to feel an overload from a lengthy lecture, they might communicate their feelings for the teacher to provide a brain-break before proceeding on with additional information.

Classroom instruction and teacher emotions. Emotions are important and influence students' abilities in learning academic skills (Caine & Caine, 2011; Jensen, 2009; Pekrun, 2014). Positive teacher emotions can support students' enjoyment of learning within the classroom and can have long-term effects on the value of learning perceived by students (Caine & Caine, 1990; Pekrun, 2014). According to Pekrun (2014), the cognitive and motivational quality of classroom instruction is necessary for students' emotional buy-ins or feelings of tasks worthiness in relationship to learning. He refers to cognitive quality as teachers' pedagogical knowledge and those teacher behaviors as identified previously as being effective. They include structure, clarity, task difficulty, and the match between task difficulty and students' competencies. The motivational quality of instruction affects the importance of learning, thereby promoting enjoyment and reducing boredom (Pekrun, 2014). To enhance cognitive and motivational quality of classroom instruction, Pekrun (2014) has urged teachers to consider the following recommendations:

1. Provide tasks that are meaningful and relevant to students' cognitive abilities and interests (Deci et al., 1994; Gagné & Deci, 2005).
2. Provide students with autonomy to self-regulate learning (i.e., goal setting, selecting tasks and strategies, and monitoring and evaluating progress.
3. Create social structures of learning to assist students with satisfying their needs for social interaction (Jensen, 2009).
4. Show positive emotions about teaching and about the subject matter as well as exhibit positive emotions and enthusiasm to their students (Caine & Caine, 2011).

Goal structures and achievement standards. Different achievement goals contribute to students' emotions (Caine & Caine, 2001; Pekrun, 2014). Mastery goals refer to mastering the learning material and to improving one's competence such as is required on criterion-referenced tests. Performance goals refer to comparing one's academic status to others such as norm-referenced based assessments. Co-operative goals refer to group achievement and facilitate social learning and interactions with others. Pekrun (2014) believes that the use of students tracking mastery of goals and curriculum standards promote students' enjoyment of learning because students' attention is focused on what they desire at the personal level to achieve. Moreover, emphasis is more likely placed on the mastery of objectives and improvement over time that lay the foundations for developing students' self-confidence and positive emotions (Pekrun, 2014). In contrast to mastery goals and standards, Pekrun (2014) believes that performance goals produce the opposite effect of mastery goals because they relate to success and failure based on the comparison of students' abilities with one another. Students might experience a range of emotions, including pride, anxiety, shame, and hopelessness (Pekrun, 2014). Moreover, Festinger (1954), noted for his social comparison theory, has been cited in more than 17,000 articles books. He believed that comparing was a natural thing for individuals to do along with assigning value to their abilities based on how they viewed themselves in relation to their peers. According to Festinger (1954), people have the tendency to evaluate their opinions and to know more about their abilities; however, when they are not capable of assessing their opinions and abilities, they oftentimes compare themselves with others (Festinger, 1954).

Test-taking and feedback. With federal government holding states accountable for students' academic achievement, students are experiencing higher levels of anxiety due to high-stakes testing in today's classrooms. Teachers might reduce the negative emotions experienced by students arising from excessive testing by ensuring that they administer well-structured tests, provide informational feedback, and avoid high-stakes testing whenever possible. Additionally, Pekrun (2014) advocates four guidelines regarding feedback about achievement in reducing students' test-taking anxieties. They are as follows:

1. Use mastery standards.
2. Use repeated feedback about success and emphasize improvement of performance.
3. Make clear to students that errors are regarded as opportunities to learn.
4. Provide informational feedback about how students can improve their competencies and attain mastery.

Family, peers, and school reform. There is an African proverb quoted by Clinton (1996), "It takes a village to raise a child" (p. 5). In so saying, when students enter the doors of the classroom, they bring with them their values and experiences from their homes, communities, and other environmental influences. In his ecological systems theory, Bronfenbrenner (1977/2009) highlighted the fact that the transference of what students learn in one environment (e.g., subject area content, verbal and nonverbal behaviors, handling emotions) is expected to be used in other environments and contextual settings. Thus, school is no different. In the early years of development, parents and caregivers are the main contributors (Bronfenbrenner, 1977/2009; Pekrun, 2014). Pride of success and shame of failure are shaped in the family from an early age (Berry, 2005; Ladson-Billings, 1990, 1995; Pekrun, 2014). For many students, parents are more important than are teachers or peers for shaping students' identity in terms of their core values, including the value of achievement. In Berry's (2005) qualitative research study involving two African American boys experiencing success in mathematics at the middle school level, parents' involvement in their children's education was one of the most important factors attributed to the two boys' achievement. Pekrun (2014) advised educators to acquire knowledge about students' home situation in better understanding students' emotions. Positive support from the families might likely aid in reducing negative emotions of students while simultaneously developing emotions that are more positive. Without family support, any attempt to strengthen positive emotions might fail when met with opposition from students' families (Pekrun, 2014).

Moreover, peers influence students' emotions in the classroom academically and socially. For example, students might compete to see who can make a better grade on an assessment, who can run the fastest, or who has more friends. Friendship networks in the classroom help to establish and to develop positive social emotions and to provide students with a sense of belonging (CASEL, 2003; Maslow, 1943; Pekrun, 2014). Because students naturally compare their abilities to that of other students and assign levels of importance, Pekrun (2014) suggested that mastery-oriented tasks with clear achievement goals and timely feedback based on learning expectations be provided to students in cooperative group settings to promote positive social skills. He also advises that educators are likely to mitigate anti-social behaviors like bullying by intervening instead of leaving the situation to students to resolve themselves (Pekrun, 2014).

Furthermore, in the larger scheme, schools provide the infrastructure and boundary conditions that facilitate or impede the implementation of appropriate educational practices within the classroom that promote positive or negative emotions experienced by students. One such method used that impact students' emotions and might result in a self-fulfilling prophecy is that of tracking. The practice of tracking begins as early as pre-kindergarten. These students are grouped according to their abilities and status of their parents. Tracking in schools has not been promising.

According to Brophy and Good (1974), tracking students might cause low achievers to have feelings of failure and frustration, whereas high achievers might develop an attitude of superiority. Brophy and Good (1974) concluded,

> …in some school systems a student's career is somewhat determined as of the day he enters school simply on the basis of his clothing, appearance, and other factors related to the SES [socio economic status] of his family but not necessarily to his ability or potential. (p. 9)

Buchmann and Dalton (2002) conducted a research investigation on the interpersonal and educational aspirations of secondary school students in 12 countries. From their findings, they observed that in countries having more differentiated secondary education, students' aspirations were largely determined by the type of school that the students attended rather than by the influence of family and peers (Buchmann & Dalton, 2002). Moreover, the researchers determined that higher educational aspirations of students attending secondary schooling in countries having undifferentiated secondary education were associated with students' mathematics achievement and their parents' education (Buchmann & Dalton, 2002). Furthermore, students having higher SES increased the probability of them reporting high educational aspirations in 11 out of 12 countries included in the study (Buchmann & Dalton, 2002). Similarly, Parker, Jerrim, Schoon, and Marsh (2016), in their study of 30 countries using the PISA database to investigate socioeconomic inequality in expectations for progression to higher education, documented that between-school academic stratification was highly associated with students' SES and their educational attainment.

In Tyson's (2011) work with more than 1,000 African American students from elementary through high school at different time periods from 1996 to 2004, she was able to observe schools attended by African American students where the student population of the schools were predominantly African American students and schools where the majority of the student population were predominantly White students. She noted that tracking within schools was evidenced by the higher enrollment of White students in the gifted and talented programs and the advanced-level classes, as opposed to the higher enrollment of African American students in lower level courses. Tyson was able to conclude that tracking tended to sort students by their intellectual abilities as to who is smart and who is not smart. Additionally, like Brophy and Good (1974) and Buchmann and Dalton (2002), Tyson (2011) determined that factors such as students' race, social class, and SES also were determinants in tracking students. She also affirmed that the practices of tracking impact how students construct views about themselves and others and where they fit within the school hierarchy (Tyson, 2011). For example, in Hines's (2017) coaching role at a high school, one particular assignment was for him to encourage 40 African American students who met the requirements to enroll in AP courses. After interviewing each student, Hines (2017) determined these students lacked awareness of Advanced Placement (AP) courses, were not interested in taking AP courses, or were informed that AP courses were stressful and declined in having challenging courses added to their course load.

Similarly, Kalogrides and Loeb (2013), in their study of three large U.S. school districts, examined the class assignments of students at the elementary, middle, and high school levels. These researchers believed that the process of sorting students by their achievement level had the consequence of exposing minority and poor students not only to less rigorous curricula but also lower quality teachers and classmates (Kalogrides & Loeb, 2013). They compared differences in the characteristics of students' peers and teachers by race, socioeconomic status, and prior achievement levels using data from each district's administrative files on all staff, students, and schools (Kalogrides & Loeb, 2013). Kalogrides and Loeb (2013) wanted to find out whether minority and poor students had (a) less experienced teachers; (b) more minority and poor classmates; and (c) lower achieving classmates because they themselves were lower achieving students. The researchers determined that some level of sorting across classrooms within schools occurred at all grade levels—elementary, middle, and high schools. Kalogrides and Loeb (2013) concluded that minority, poor, and low-achieving students were more likely to have lower achieving and less advantaged classmates as compared to White and non-poor students in their grade at their school. They also observed that these same students were more likely to have novice teachers (Kalogrides & Loeb, 2013). Like other researchers (Brophy & Good, 1974; Buchmann & Dalton, 2002); Tyson, 2011), Kalogrides and Loeb (2013) evidenced the effects of tracking and concluded that within-school sorting explained some of the within-school gaps in student achievement gains.

Oftentimes in academic settings, many educators focus on the subjects (e.g., reading, mathematics, language arts, science, social studies) that influence states' accountability ratings set forth by the federal government. This practice is referred to by many in the field of education as teaching to the test. Additionally, many school administrators view social and emotional learning as being less important than is academic learning, not realizing that when students are socially and emotionally safe, that is half the challenge of teaching (Caine & Caine, 1990; 2011; Jensen, 2009; Jones et al., 2013; Pekrun, 2014).

Balancing social, emotional, and academic learning. Educational leaders, child advocates, and researchers from various fields met at a meeting hosted by the Fetzer Institute in 1994 to promote positive development in children. The need for such a meeting was sparked by two entities—previous research work conducted on prevention and resilience and interest generated by the publications of Goleman's (1995) *Emotional Intelligence* and Gardner's (1993) *Multiple Intelligences* (Mayer, Roberts, & Barsade, 2008; Zins & Elias, 2006). From this meeting, CASEL, a collaborative organization of educators and researchers, was founded. Also resulting from this meeting was the creation of the term "social and emotional learning" and defined by the newly established CASEL (2003) as "the process of developing the ability to recognize and manage emotions, develop caring and concern for others, make responsible decisions, establish positive relationships, and handle challenging situations effectively" (p.9). From the growing body of research on the impact of social and emotional learning on academic learning, Zins, Bloodworth, Weissberg, and Walberg (2004) introduced the term "social, emotional, and academic learning (SEAL)" (p. 19).

Elias (2006, p. 6) has referred to SEL as "the missing piece" because it characterizes an aspect of education that associates academic knowledge with a specific set of skills central to students' success in school and in life. According to Elias (2006) and Weissberg, Durlak, Domitrovich, and Gullotta (2015), parents and community leaders want students to

- be fully literate and able to benefit from and make use of the power of written and spoken language, in various forms and media;
- understand mathematics and science at levels that will prepare them for the world of the future and strengthen their ability to think critically, carefully, and creatively;
- be good problem solvers;
- take responsibility for their personal health and well-being;
- develop effective social relationships, such as learning how to work in a group and how to understand and relate to others from different cultures and backgrounds;
- be caring individuals with concern and respect for others;
- understand how their society works and be prepared to take on the roles that are necessary for future progress; and
- develop good character and make sound moral decisions.

Moreover, the Association for Supervision and Curriculum Development [ASCD] refer to these competencies as “the development of the whole child,” (ASCD, 2014, p. 7). In conjunction with the U. S. Centers for Disease Control and Prevention (CDC), the ASCD (2014) *Whole School, Whole Community, Whole Child* (WSCC) Model, similar in nature to that of CASEL’s (2003) SEL framework was developed. As mentioned previously, Elias (2006) referred to SEL as the “missing piece” to connecting academic skills with certain social and emotional skill sets (p. 6). Basch (2011) considered students' health as the "missing link" to students' academic success (p. 593) in closing the achievement gap. Although health issues are included in the SEL competencies (Elias, 2006), Basch (2011) admonished,

> No matter how well teachers are prepared to teach, no matter what accountability measures are put in place, no matter what governing structures are established for schools, educational progress will be profoundly limited if students are not motivated and able to learn. Particular health problems [vision, asthma, teen pregnancy, aggression and violence, physical activity, breakfast, and inattention and hyperactivity] play a major role in limiting the motivation and ability to learn of urban minority youth. (p. 593)

Further, Elias (2006) believed that the retention of academic learning and SEL learning are built on positive caring relationships and welcoming, but challenging classroom and school environments. It is environments such as these that he believes is important for educators to provide the eight essentials necessary for a balanced academic-social-emotional learning that will influence students' success in school and in daily living (see Table 5). Additionally, there are crossovers with Pekrun's (2014) 10 principles for provoking positive emotions in the classroom (see Table 5) and Elias's (2006) eight essentials for balancing academic-social-emotional learning. See Table 6 for a comparison of the relationship between emotions and social emotions in the classroom.

Table 6

Comparison Between Pekrun's (2014) 10 Principles to Evoke Positive Emotions and Elias's (2006) Academic-Social-Emotional Learning Competencies

Pekrun 's (2014) 10 Principles to Evoke Positive Emotions and Students' Development in the Classroom	Eight Essentials for Academic, Social, and Emotional Balance
Family, peers, and school reform • Involve parents • Take care of the peer climate in the classroom • Contribute to school reform	Link social-emotional instruction to other school services • Explicitly teach social-emotional and life skills. • Provide instruction in the prevention of specific problems • Provide guidance in healthy lifestyle choices.
Goal structures and achievement standards • Mastery goals–individual progress (promote enjoyment of learning • Performance goals—comparing to others' performance (anxiety) • Cooperative goals—cooperative learning (builds relationships) Test-taking and feedback • Use well-structured tests • Provide informational feedback • Avoid high-stakes testing	Use goal setting to focus instruction. • Present learning in terms of understandable goals. • Provide learning experiences that connect and can be integrated into different aspects of learning across various subject areas, over time, and everyday life. • Provide opportunities for students to engage in problem solving activities.
Individual and cultural differences • Consider individual uniqueness • Consider cultural uniqueness Positive/Negative emotions and learning • Attention • Motivation • Learning strategies • Self-regulation of learning Classroom instruction and teacher emotions • Provide instruction and tasks that have high cognitive value • Provide meaningful and relevant tasks • Provide autonomy for self-regulation • Display emotions that show enjoyment of teaching the lessons	Used differentiated instructional procedures • Use different modalities in lesson delivery, varying content, work processes, products, scoring systems, assessments, time, and cooperative grouping. • Provide regular and constructive feedback. • Provide opportunities for classroom discussions. • Provide students with reflection time. • Provide opportunities for project-based learning.

(continued)

Pekrun 's (2014) 10 Principles to Evoke Positive Emotions and Students' Development in the Classroom	Eight Essentials for Academic, Social, and Emotional Balance
Test-taking and feedback • Use well-structured tests • Provide informational feedback • Avoid high-stakes testing	

Understanding emotions
• Influence learning
• Four types of emotions
  o achievement—success/failure
  o epistemic--cognitive
  o topic—empathy/disgust
  o social emotions—love/sympathy
	Promote community service to build empathy.
	• Service experiences provide students with the opportunity to engage in helpful activities with other people in ways that broaden their perspectives and empathic understanding.
	• Helps prepare students to be caring, contributing adults in their community.

Family, peers, and school reform • Involve parents • Take care of the peer climate in the classroom • Contribute to school reform	Involve parents • The collaboration between home and school is important in developing SEL skills. • Schools and communities need to support parents with resources to provide home environments conducive to learning.
Self-confidence, task values, and emotions • Self-confidence promotes hope for success • Emotions are dependent on task values Emotion regulation • Emotion-oriented regulation • Appraisal-oriented regulation • Competence-oriented regulation • Situation-oriented regulation Classroom instruction and teacher emotions • Provide instruction and tasks that have high cognitive value • Provide meaningful and relevant tasks • Provide autonomy for self-regulation • Display emotions that show enjoyment of teaching the lessons	Build social-emotional skills gradually and systematically • Prior to selecting and implementing an approach to SEL examples of information for consideration include local needs, goals, interests, staff skills, and acceptability to parents. • SEL needs linking to language literacy, instruction in math and science, history and current culture, health and physical education, and the performing arts.

(continued)

Pekrun 's (2014) 10 Principles to Evoke Positive Emotions and Students' Development in the Classroom	Eight Essentials for Academic, Social, and Emotional Balance
Family, peers, and school reform • Involve parents • Take care of the peer climate in the classroom • Contribute to school reform	Prepare and support Staff well • Effective academic and social-emotional instruction benefits from well-planned professional development for school personnel. • The kinds of professional development activities that are beneficial include training staff in children's social-emotional development, modeling and practice of constructivist and project-based teaching methods, multimodal instruction, coaching, and mutual feedback from colleagues.
Family, peers, and school reform • Involve parents • Take care of the peer climate in the classroom • Contribute to school reform	Evaluate what you do/Reflect on practices • Monitor SEL regularly, using multiple indicators to ensure programs are carried out as planned. • Gathering relevant information might include–teachers' reflections of practices, checklist to track SEL activities, student surveys, and design SEL indicators to measure SEL progress.

Note: This is an original table adapted with permission from the work of Pekrun's (2014) 10 Principles to Evoke Positive Emotions and Elias's (2006) Academic-Social-Emotional Learning Competencies. (See Appendix E).

Strategies for Engaging African American Boys in Mathematical Content

In the review of the literature conducted by Brophy and Good (1974), the researchers examined factors (e.g., race, students' sex, teachers' sex, social class differences, students' personality, teachers' expectations, writing neatness, speech characteristics) that might attribute to the quality of teacher-student relationships. One observation noted by Brophy and Good (1974) was that teachers in general tend to prefer compliant and cooperative children and to reject assertive and active children. More recently, Wilkins (2014) conducted an investigation on the qualities of students' behaviors that teachers believed contributed to good teacher-student relationships. A total of 103 teachers from eight high schools with student populations in excess of 750 students in a Northeastern state participated in the study by responding to an on-line survey. Afterwards, a separate survey was sent to students asking them to name one or more teachers with whom they had good relationships. The teacher whose name was mentioned the most was selected to participate in the face-to-face interview. As a result, students from five out of the eight high schools responded; thus, five of the teacher-participants were selected to take part in the interview. From the survey results, Wilkins (2014) was able to conclude that teachers preferred students who: (a) demonstrated engagement and interest in schoolwork; (b) were respectful, rule-abiding, and cooperative; and (c) demonstrated positive social behaviors. Drawing from the face-to-face interviews, Wilkins (2014) was able to confirm the results of the teacher-survey. Teachers enjoyed working with students who tried hard in class, had a sense of humor, were respectful, and talked to the teachers (Wilkins, 2014).

Unfortunately, a number of African American boys have been diagnosed with Attention Deficit Hyper-Activity Disorder (ADHD) and might engage in behaviors of opposition and aggressiveness (Kunjufu, 2011). Needless to say, these types of behaviors impact the learning achievement of many African American boys because some teachers might have less tolerance for working with students who do not possess teachers' preferred student-qualities—compliance and cooperation (Brophy & Good, 1974; Wilkins, 2014). If this is the case, then how can educators support the learning of African American boys? In spite of the large number of African American boys performing at lower rates of academic achievement as compared to their peers (NCES, 2011) , there are many African American boys who have been successful in their mathematics achievement (Berry 2005; Kunjufu, 2011; Ladson-Billings 1990, 1995; Walker & McCoy, 1997/2013). More specifically, based on Kunjufu's (2011) work with African American students, especially boys, he noted that these students possess strengths in their auditory skills, oral skills, visual-picture skills, and tactile/kinesthetic skills. He has encouraged educators to incorporate the strengths of African American boys in the planning for and implementation of instructional activities (Kunjufu, 2011). Edwards and Polite (1992) believed that researchers should focus their studies on finding positive strategies for working with African American boys that impacted the academic success of these students. In the sections that follow, similar works of other researchers who have contributed to the growing body of literature in finding positive ways to support African American boys succeed in school will be discussed in the hope that many more African American boys might experience similar successes. These positive strategies include culturally relevant teaching, mathematics discourse, demonstrations of mathematics understanding, and student motivation.

Culturally relevant teaching. In what constitutes the successful teaching of African American students, Ladson-Billings (1990) like other researchers (e.g., Ford & Moore, 2013; Howard, 2010; Leonard & Martin, 2013; Leonard, Moore, & Brooks, 2014; Varelas, Martin, & Kane, 2013) believed that instruction that presented African American students the opportunity to choose academic excellence without losing "a sense of personal and cultural identity" (p. 337) was fundamental. It is in this vain that Ladson-Billings (1990) described pedagogical excellence as being teachers' ability to foster students' choice of academic excellence while maintaining students' cultural integrity. According to Ladson-Billings (1995), culturally relevant teaching is a pedagogy committed to students' collective empowerment that rests on three criteria. The first criteria of culturally relevant teaching is that students must experience academic success. No matter how much attention students receive or how strong the student-teacher relationship, evidence of learning must take place. The second criteria of culturally relevant teaching is that students must develop cultural competence. In developing students' cultural competence, teachers utilize students' culture, background experiences, and/or strengths and affinities as avenues for learning. The third criteria of culturally relevant teaching is students must develop a critical consciousness through which they challenge social norms. Teaching students to analyze critically conditions in their ecosystems supports the preparation of students for active citizenship. Similarly, Freire (2005), cited more than 66,000 times in his work on critical consciousness to elevate the poor masses of Brazilians, used the term "conscientization" (p. 132) to refer to the process that invites learners to engage the world and others critically.

Moreover, Ladson-Billings (1995) believed that prospective teachers who might work in poor urban schools needed to understand culture (their own and others) and the ways that culture functions in the educational setting (Milner, 2011). She also believed that multicultural classes or human relation courses tended to "exoticize" (Ladson-Billings, 1995, p. 483) or portray minority students as being unusual or different by referring to these students as "other" (Ladson-Billings, 1995, p. 483). Therefore, Ladson-Billings (1995) advocated the importance of culturally relevant pedagogy. This type of pedagogy is designed "to problematize teaching and encourage teachers to ask about the nature of the student-teacher relationship, the curriculum, schooling, and society" (p. 483). In this way, focus is not only on the behaviors and academic abilities of students, but includes the contextual setting over which students have no control (Schmidt et al., 2009).

Ladson-Billings's (1995) quest toward a theory of culturally relevant pedagogy builds on the work conducted by researchers on psychological models of pedagogy (e.g., Haberman, 1991a, 1991b; Shulman, 1987), microanalytic work of sociolinguists (e.g., Au & Jordan, 1982; Mohatt & Erickson, 1981; Vogt, Jordan, & Tharp, 1987), macrostructural analysis of cultural ecologists (e.g., Ogbu, 1981; Siddle-Walker, 1993; Villegas, 1988), and her personal experiences as an educator and researcher. Ladson-Billings conducted an ethnographic qualitative research study in a predominantly African American school district with a population of less than 3,000 students. Teachers who worked at one of the elementary schools in a low socio-economic area participated in the study. The process for selecting these teachers involved a community nomination, where African American parents attending local churches in the community shared who they thought were outstanding teachers based on being respected by the teacher, students' enthusiasm toward school and academic tasks, and students' attitudes toward themselves and others. The parents' list of excellent teachers was crosschecked by an independent list of excellent teachers compiled by principals and teaching colleagues. The principals' criteria for teaching excellence consisted of classroom management skills, student achievement, and personal observations of teaching practice. Teachers whose names appeared on both lists were invited to participate in the 2-year longitudinal study. Eight female teachers—five African American teachers and three White teachers who taught in

Grades 4-6—participated in the study. Further, the study was composed of four phases. The first phase involved an ethnographic interview with each teacher to discuss her background, philosophy of teaching, and ideas about curriculum, classroom management, and parental and community involvement. The second phase of the study involved teachers agreeing to unscheduled classroom observations over a 2-year period in which the researcher visited an average of 3 days per week. In these classroom observations, the researcher took field notes, audiotaped the class, and conferenced with the teacher after each visit. The third phase involved videotaping the teachers and overlapped with the second phase. Finally, the fourth phase of the study required that the teachers work together as a research collaborative in ten 2- to 3-hour meetings to view segments of one another's videotapes where they analyzed and interpreted their practices and the practices of their peers. From this research collaborative, Ladson-Billings (1990, 1995) was able to confirm teaching practice to culturally relevant pedagogy that had emerged in the initial interviews with each teacher. These consistent themes included the teachers' conceptions of self and others, social relations, and conceptions of knowledge.

In another 2-year qualitative study, Milner (2011), like Ladson-Billings (1995), used culturally relevant pedagogy as the theoretical framework to drive his research. However, unlike Ladson-Billings (1995), Milner (2011) centered his investigation on uncovering and explaining ways in which teachers might develop their cultural competence to maximize student learning opportunities, whereas Ladson-Billings (1995) focused on teachers developing students' cultural knowledge of their community and society at-large. Setting the context for his study, Milner (2011) selected an urban middle school through community nominations. The school was situated in a median income area where houses sold for between $120,000 and $175,000 and students living in the community attended private schools. Approximately 354 students from mostly lower socio-economic backgrounds attended the middle school. The student population consisted of 60% African American students, 32% White students, 6% Hispanic students, and 2% Asian and Indian students (Milner, 2011). The teacher population consisted of 45% African American teachers and 55% White teachers. Milner (2011) selected one White male science teacher who was nominated by the principal of the school to participate in his study. The teacher was a 3-year veteran and had been nominated and selected by his peers as the teacher of the year. Through triangulation of field notes, semi-structured interviews, and tape-recordings, Milner (2011) was able to note the following themes that he believed contributed to the teacher building and practicing cultural competence:

- The teacher was able to build and to sustain meaningful and authentic relationships with his students by: (a) setting up opportunities in and out of school to build common experiences with them; and (b) listening to, learning from, and attending to their diverse needs.
- The teacher recognized the multiple layers of identity among his students and confronted matters of race by revealing himself through narratives to present himself as a person and by comparing and contrasting how he and the students were alike in some ways and different in other ways, thereby helping students to understand how they to fit into the larger society.
- The teacher perceived teaching as a communal affair—a culture of care and collaboration in that he worked to create a culture of collaboration

with colleagues and considered all students in the school to be his responsibility.

Through his observations and interviews, Milner (2011) was able to surmise that cultural and racial convergence were necessary as a foundation for the academic success of the students. He concluded that the teacher in his study was able to develop congruence with his students because he developed cultural competence about them, thereby deepening his knowledge and understanding of himself and, as such, was able to support students' understanding of their place in society (Milner, 2011).

Conceptions of self and others. The teachers in Ladson-Billings's (1990) study viewed themselves as "artist and teaching as an art" (p. 340). The researcher observed that the teacher participants stressed commitments to extend teaching beyond basic knowledge and skills and that they looked at teaching as "pulling knowledge out" (p. 340) of their students. Ladson-Billings (1995) and Milner (2011) also noted that the teacher-participants in their studies had love for teaching and understood children. Moreover, the teachers saw themselves as members of the community and teaching as giving back to the community (Ladson-Billings, 1995; Milner, 2011). The teachers in Ladson-Billings's (1995) study also felt responsible for instilling the gift of giving to their students by encouraging and engaging their students to support the students' communities in which they lived (Leonard & Martin, 2013). Other researchers support using instruction as a vehicle for engaging students in their communities. Focusing on mathematics instruction, Leonard and Martin (2013) advocated that mathematics instruction should create opportunities for students to express themselves and the needs of their communities as a means to promote social justice both within their classrooms and communities.

Additionally, the teachers in Ladson-Billings's (1990) study believed that all students could succeed and, thus, helped students to identify how they fit into society at large. The approach was different for the teacher participant in Milner's (2011) study in that the teacher sought ways to develop his cultural competence. This act of developing his cultural competence in turn provided an avenue to help his students understand how they fit in with society as a whole (Milner, 2011).

Social relationships. Ladson-Billings (1990) and Milner (2011) were able to conclude from the results of their studies that the structure of social relations was critical in successful teaching. The researchers in both studies observed in the classrooms of the teacher-participants that the teacher-student relationship was fluid and equitable (Ladson-Billings, 1990; Milner, 2011). These relationships often extended beyond school into the community. The teachers also demonstrated a connection with all students and saw their classes of students as being families (Ladson-Billings, 1990; Milner, 2011). Moreover, the teachers emphasized communities of learners as a whole where everyone was expected to learn and excel (Ladson-Billings, 1990; Milner, 2011). They also encouraged collaborative and cooperative learning with the expectation for students to teach and to be responsible for one another (Ladson-Billings, 1990; Milner, 2011).

Similar findings of the importance of social relationships and teachers' caring have been substantiated by a number of researchers (Bill and Melinda Gates Foundation, 2013a; Bronfenbrenner, 1977/2009; Elias, 2006; R. Ferguson, 2012; Jennings & Greenberg, 2009; Hughes & Acedo, 2016; Jensen, 2009; Pekrun, 2014; Roeser et al., 2012; Tate, 1995/2009; Walker & McCoy, 1997/2013). For example, Walker and McCoy (1997/2013) conducted an ethnographic qualitative research study to investigate the beliefs and ideas that African American students had about mathematics. Seventeen African American students in Grades 9-12 from a high school situated in a small city with a population of 1,250 students—30% African American, 65% White, and 5% other—participated in the study. The student participants—nine female and eight male had been selected based on differing levels of achievement. The breakdown of participants enrolled in the mathematics courses were as follows: (a) four students enrolled in Algebra 1; (b) 11 students enrolled in Geometry; (c) one student enrolled in Algebra 3; and (d) one student enrolled in Honors Algebra 2. In structured interviews (held during lunch time, study hall, or after school), all students were asked open-ended questions about their attitudes toward mathematics. One such question was "What influences your mathematics performance?" (p. 316). Walker and McCoy (1997/2013) was able to conclude from the results of their study that whether teachers cared or not was an important aspect to African American students. Those students participating in the study who perceived that they had a personal relationship with their teacher were confident and desired to produce their best work in that teacher's class.

In Berry's (2005) phenomenological qualitative research study, he sought to capture factors that played a role in African American male middle school students' success in mathematics. The researcher used the critical race theory of education (Tate, 1997) as his theoretical framework because of the role racism has played in the shaping of schools and schooling practices. Berry (2005) used descriptive portraits to tell the stories of the two participants involved in his study. As a result, the researcher was able to identify five broad themes. One such theme was that of self-empowerment. The African American male participants were motivated to succeed, confident in their mathematical abilities, held positive views of their self-image, and identified a teacher who expressed care and provided encouragement and motivation. The two participants discussed how teachers asked them about their performance in other classes and spent extra time with them when they were having trouble with mathematics. Collins (2000) has used the term "ethic of caring" (p. 263) to describe the importance of honoring individual differences, the appropriateness of emotions in dialogues, and the capacity for empathy, because it is through this type of caring that girds trustful teacher-student relationships and prompts African American students to thrive in their coursework.

Conceptions of knowledge. As mentioned previously, teachers have to be knowledgeable about the content that they teach to design and to implement lessons that take into account the unique needs of diverse learners in their classrooms. In teaching African American boys, Kunjufu (2011) shared that what matters is the teachers' expectations, time allocated to the task at hand, subject knowledge and delivery, and classroom management skills. He suggested that in making mathematics lesson relevant and meaningful to African American boys it would be beneficial to connect concepts to sports, music, money, and their neighborhoods. One example suggested involved connecting circumference to a basketball and hoop. Another example was emphasizing the relations of decimals and percentages to money. Yet another example was connecting history and geography to the students' neighborhoods or having students watch rap videos and write and discuss the lyrics. In Ladson-Billings's (1990) study, the successful teacher participants practiced culturally relevant pedagogy by providing students opportunities to engage in problem-based learning where students solve problems within the communities in which they lived (Leonard & Martin, 2013). Additionally, the teachers also challenged the curriculum and made informed decisions about what was worth knowing in the lives of their students (Ladson-Billings, 1995; Leonard & Martin, 2013). The teacher in Milner's (2011) study, incorporated the practice of allowing students to have second chances. He communicated failure was not an option and students were to complete all assignments and re-work assignments not meeting standards (Milner, 2011). The practice of decision-making by teachers in both Ladson-Billings's (1995) and Milner's (2011) impacted the opportunity for students to learn in positive ways (Schmidt et al., 2009) and is included in the factors of teacher behavior as one of the factors guiding what teachers teach by Porter and Brophy (1988) (cf. Figure 4). Although it is of importance for teachers to have conceptions of knowledge, it is also of importance for students to be able to communicate the transference of that knowledge imparted by their teachers.

Mathematics discourse. The notion of having students verbalize their learning promotes the development of reasoning and thinking abilities (Freire, 2000, 2005; Grant, Crompton, & Ford, 2015; Jensen, 2009; Ladson-Billings, 1995; Levine, 2002; McCrone, 2005; Tate, 1995/2009). When individuals engage in dialoguing, they might gain insight into one another's thinking while, at the same time, broadening their perspectives and understanding of the discussion topic. Freire (2000, 2005) believed that where there is no dialogue, learning cannot take place. In the mathematics classroom, open discussions provide students with the opportunity to share their thinking and to internalize key concepts (McCrone, 2005). According to Kunjufu (2011), African American boys have strong verbal and oral skills and could benefit from instructional activities that are high in demand for auditory and oral learning. Ladson-Billings (1995) observed the teacher participants in her study using complex assessment strategies. These teachers advocated providing students with complex assessments that went beyond the correct answer, but were open-ended assessments where students would have to provide their rationale for their answers drawing on higher order cognition or critical thinking (Ladson-Billings, 1995; Tate 1995/2009). In addition to drawing information out of students as supported by Freire (2005), the teachers helped the students to find their voice and to self-advocate for themselves with the ability to code-switch between African American language and standard form of English as well as role-switch between school and home (Ladson-Billings, 1995).

In Murrell's (1994) qualitative research study, in search of responsive teaching, he identified responsive teaching as, "the systematic and analytic implementation of discourse patterns and speech activities that optimally support and sustain an ecology of developmental learning, reasoning ability, and performance for all children" (p. 565). His ethnographic research study involved 12 African American male sixth-grade students who had been designated by their teachers and student-teachers as having low mathematics abilities and having failing grades. From Murrell's (1994) study, he observed that the student participants placed greater emphasis on their ability to manipulate situations and people as opposed to gaining understanding of mathematical ideas and information shared through dialogue. He noted that these students also attempted to meet performance requirements set by their teachers (e.g., classroom participation rules) as opposed to increasing their understanding of the learning objective.

Murrell (1994) surmised that to teach more responsively, the teachers needed to merge the students' frame of discourse with the frame of discourse for mathematics understanding. He believed that the teachers also needed to set the expectations for students' performance in using their reasoning and thinking abilities in terms of mathematics. Finally, in his quest for responsive teaching, Murrell (1994) concluded that, as responsive teachers strategize their teaching of mathematics concepts, they must simultaneously include multiple, consistent opportunities for students to be involved in activities that allow them to verbalize the learning experience of mathematics concepts. Murrell (1994) believed that teachers needed to take in consideration the social interaction dynamics that come into play in the classroom with verbal discourse between teacher and students and among students. Thus, in conceptualizing a speech activity, he believed that teachers must make explicit the rules of talk and performance expectancies for all occasions of classroom discourse, including cooperative group discussions and informal off-task talk as well as whole-class inquiry (Murrell, 1994). Moreover, Murrell (1994) also determined that responsive teachers must be continuously aware that the relationship students construct with their teachers, as well as with the subject matter, is shaped by the degree to which discourse routines and speech events promote interest, social participation, and a sense of efficacy (Berry, 2005; Kunjufu, 2011), industry, and a sense of purpose (Berry, 2005; Caine & Caine, 2011; Chesebro & McCroskey, 2001; Christophel, 1990; Comadena et al., 2007; Frymier et al., 1996; Houser & Frymier, 2009; Ladson-Billings, 1995; Mottet et al., 2008; Walker & McCoy, 1997/2013).

Additionally, Murrell (1994) identified five frames of discourse within which the African American male students normally operated that teachers should consider when designing and implements lessons. The first frame of discourse identified was a preference for request-for-information teacher inquiries where the teachers asked questions to specific students and the students supplied the answers. Walker and McCoy (1997/2013) also observed similar behaviors of African American students only responding when teachers asked questions directed at a particular student within the mathematics classroom. The second frame of discourse was the question-posing, teacher-challenging approach where the teacher engaged students in open questions. As such, the student participants rarely responded to the question-posing discourse unless it was a unison response. The third frame of discourse was an eagerness for the student participants to show off the information that they possessed in that they viewed it as an expected performance to obtain a good grade rather than internalizing mathematics concepts. The fourth frame of discourse was the participants had a penchant for extended explanations in that they enjoyed the attention that they received from their peers. Finally, the fifth frame of discourse practiced by the participants was a preference for "getting over" (Murrell, 1994, p. 567) rather than admitting to not knowing the answer. These students were more likely to engage in superficial aspects of mathematics talks. Of particular importance is that the African American students regarded verbal adroitness as a criteria for doing well in the mathematics class as opposed to the need of understanding mathematics concepts and ideas (Murrell, 1994).

Interestingly, McCrone (2005) observed how the roles of the teacher and students in a fifth-grade mathematics classroom changed over a course of a school year in her qualitative research study. The teacher's role evolved from explicitly modeling and explaining expected responses to a discussion facilitator or coach. The students' role changed from being receivers of information to contributors in mathematical discussions. McCrone (2005) was able to conclude that when the teacher and students shared responsibility for finding ways of working together and communicating mathematical concepts, mathematical discussions were enhanced.

Similar findings were evidenced in the work of Grant et al. (2015) as the researchers examined the mathematics identity development of six Black male students over the course of a 4-year period. Grant et al. (2015) defined mathematics identity as "participation through interactions and positioning of self and others" (p. 83). This study was part of a larger study known as the Algebra Project Cohort Model (APCM) initiative (Moses & Cobb, 2001) that was designed for accelerating mathematics understanding for mathematics students who were likely to be underserved by schools and society at large. The APCM was comprised of three parts: a cohort structure, curriculum and pedagogy, and community outreach. Grant et al. (2015) was able to capture about 450 minutes of video recordings of small-group, mathematics problem solving in which students' actions were coded as acts of participation in the categories of: (a) students exercising individual problem-solving practices, (b) students exercising collaborative problem-solving practices; and (c) for whom students were observed being accountable. From their analysis of the data, Grant et al. (2015) determined that students' confidence in self and peers increased over the 4 years and that their reliance on the instructor or other knowledgeable person decreased. The researchers also observed that students consistently chose to engage in mathematics as they were given autonomy to work individually or cooperatively to communicate their ideas and knowledge about problem-situations. Although, mathematics discourse has been considered by researchers as an effective tool, it is just one way learning is achieved and internalized by students. Making use of more sensory pathways during instructional delivery and assigned tasks optimizes learning the target objective by all students (Jensen, 2005) whereby students are able to demonstrate their mathematics understanding.

Demonstration of mathematics understanding. In the responsive teaching of African American boys, Murrell (1994) advised that instructional practices designed to develop conceptual understanding must be embedded not only in the classroom discourse, but also in the organization of the learning task. In other words, these students need to be actively engaged in the learning of mathematics. In Ladson-Billings's (1995) study, the teacher participants believed that knowledge was about doing and designed their lessons from that frame of reference. According to Jensen (2005), we use our mind and body to learn and, as such, social (Caine & Caine, 2011; Gardner, 1993; Hughes & Acedo, 2016; Mayer et al., 2008; Pekrun, 2014; Zins & Elias, 2006), emotional (Caine & Caine, 2011; Gardner, 1993; Goleman, 1995; Mayer et al., 2008; Pekrun, 2014; Zins & Elias, 2006), and physical well-being of the students and the context (Bronfenbrenner, 1977/2009) of learning must be taken into account to meet the needs of diverse learners. Murrell (1994) also advised that learning achievements be based on students' demonstration of understanding mathematics through authentic work and products and not just stand-alone verbalization of knowledge (Hughes & Acedo, 2016; Jensen, 2005; Kunjufu, 2011; Ladson-Billings, 1995; Shulman, 1987; Walker & McCoy, 1997/2013).

Plainly stated, the incorporation of Shulman's (1987) instructional selections (e.g., role-playing, guided practice, cooperative learning, and modeling) to transform teachers' knowledge and understanding to students' knowledge and understanding is also needed for African American boys. The teacher-participants in Ladson-Billings's (1995) investigation were able to impart successfully their content knowledge to all their students in the learning process by structuring relevant learning tasks. Tate (1995/2009) also found the teacher participant in his study to be successful at putting culturally relevant theory into practice. Thus, these teacher participants were able to tap into the emotions of their students by building caring relationships (Ladson-Billings, 1995; Tate 1995/2009). They also provided students with a sense of autonomy by engaging them in the decision-making process and helping students to make connections to content knowledge gained in the classroom to meaningful real-world experiences, thereby activating students' motivation because their students looked forward to learning (Ladson-Billings, 1995; Tate 1995/2009).

Student motivation. In previous sections in this literature review, teacher effects and the dispositions of students' social and emotional competencies were discussed in detailed. Yet, many instructors feel ineffective in motivating students and lack the knowledge and skills confidently and systematically to diagnose and to solve motivational problems, or to meet the motivational needs of students (Hardre´ & Sullivan, 2008). Additionally, some teachers do not see themselves as contributors when it comes to knowing how to motivate students that can be detrimental to students' learning. In the case of Berry's (2005) investigation, the African American boys attributed one of the factors in their successful mathematics achievement to a teacher who expressed care and provided encouragement and motivation.

In working with 192 introductory psychology students on factors facilitating internalization based on the self-determination theory, Deci et al. (1994) reported specific contextual supports that promoted internalization and integration or intrinsic motivation toward learning—a meaningful rationale, acknowledgement of feelings, and autonomy. Moreover, Keller (1987) argued that for students to be internally motivated to learn, their attention needs to be captured and maintained, course material must be perceived as useful, and students must feel confident and satisfied with their learning (Caine & Caine, 2011; Pekrun, 2014).

To move students from extrinsic or external rewards to intrinsic motivation teachers might display sincere concern for their students' cognitive, emotional, and physical needs (Pintrich, 2003). They might also afford students hands-on experiences and increase students' self-esteem and self-efficacy in mathematics and science by asking them to construct concept problems, provide solutions, and explain their answers (Pintrich, 2003). For example, researchers have concluded that students who are engaged in hands-on learning activities outperform their peers, as do students who have the benefit of individualized instruction (Akey, 2006; Frymier, 2005; Singh, Granville, & Dika, 2002; Wenglinsky, 2000). Moreover, Gagné and Deci (2005) contended that the emphasis of importance of a task, autonomy, and inter-relatedness of task to peers aided in the transference of extrinsic motivation to autonomous motivation wherein workers felt valued. It is evident through the research presented that caring relationships, having autonomy, using strengths and affinities in the learning process, and feeling the importance of their work contributions are the driving forces that educators need to take into account in motivating African Americans boys to realize success in their mathematics achievement.

Summary of the Literature Review

The preceding review of the literature was organized into four sections: (a) mathematical literacy, (b) teachers' effects, (c) social and emotional learning, and (d) strategies for engaging African American boys in mathematical content. In the discussion of mathematical literacy, students must have the capacity to formulate, to employ, and to interpret mathematics in a variety of contexts (OECD, 2016a). Students also must have cognitive fundamentals or abilities such as communicating, mathematizing, representing, reasoning, devising strategies for solving problems, incorporating various forms of language and operations, and using mathematical tools across an array of mathematical content (OECD, 2016a).

Next, from the body of research presented, teachers' effects can be the deciding factor in whether students survive the challenge of school (Levine, 2002). Mathematics teachers must be able to set learners up for successful mathematical experiences (Helwig et al., 2002; Leonard & Martin, 2013; Pogrow, 2009; Shellard, 2004). Therefore, it is paramount for teachers to have in-depth content and curriculum knowledge as well as pedagogical knowledge, and understanding about learners and their characteristics (Darling-Hammond, 2006; Ertmer, 2003; Hill & Lubienski, 2007; Leonard & Martin, 2013; Shulman, 1987; Zimmerman et al., 1992). Some researchers have attributed teachers' behaviors, such as clarity, immediacy, and content knowledge, to the empowerment of students becoming responsible, life-long learners (Houser & Frymier, 2009; Hughes & Acedo, 2016).

In discussing, social and emotional learning, several researchers suggest that when students are disengaged, do not have a sense of well-being, and no hope or goals for the future, they are not apt to learn in school (Barringer, Pohlman, & Robinson, 2010; Becker & Luthar, 2002; Casteel, 1997; Levine, 2002; Milner, 2011; Preckel, Holling, & Vock, 2006). Emotions are a part of everything that we do and cannot be ignored. It is necessary for teachers to be aware of their emotions as well as the students to support positive emotions that influence learning in the classroom (Caine & Caine, 2011; Jensen, 2009; Pekrun, 2014).

Finally, researchers who have conducted studies on African American boys who have been successful in their mathematics achievement have suggested that (a) teaching must be culturally relevant (Ladson-Billings, 1990, 1995; Leonard & Martin, 2013; Tate, 1995/2009; Warren, 2017) and caring (Bill and Melinda Gates Foundation, 2013a; Bronfenbrenner, 1977/2009; Elias, 2006; R. Ferguson, 2012; Jennings & Greenberg, 2009; Jensen, 2009; Milner, 2011; Pekrun, 2014; Roeser et al., 2012; Tate, 1995/2009; Walker & McCoy, 1997/2013); (b) dialoguing about the mathematics content deepens mathematical concepts (Freire, 2000, 2005; Jensen, 2009; Ladson-Billings, 1995; Levine, 2002; Leonard & Martin, 2013; McCrone, 2005; Tate, 1995/2009); (c) demonstrating the understanding of mathematics should go beyond verbal discourse and include tactile/kinesthetic tasks (Jensen, 2005; Kunjufu, 2011; Ladson-Billings, 1995; Leonard & Martin, 2013; Shulman, 1987; Walker & McCoy, 1997/2013); and (d) providing students with autonomy, meaningful tasks, and inter-related of the task to peers (Gagné & Deci, 2005) should be considered in the planning for and the implementation of mathematics learning tasks for this body of students to be successful. Presented in Chapter III is the methodology of the study that includes the research design, selection of participants, instrumentation, data collection, and data analysis.

CHAPTER III

METHODS

According to Creswell (2014), there are three commonly used approaches or plans and procedures for conducting research investigations: qualitative research, quantitative research, and mixed methods research. In general, the qualitative research approach involves exploring and understanding the lives of individuals or groups to ascertain their meanings of problems encountered in the course of living and in social context (Creswell, 2014). Researchers using the qualitative research approach collect data involving the participants' settings. Questions and procedures emerge as ongoing through the qualitative research process, and the researchers interpret themes, typically, via inductive reasoning. Qualitative research approaches also convey the necessity of representing the complexity of a situation due mostly to involving the study of humans.

In contrast, the quantitative research approach involves testing theories by investigating the relationships among variables (Creswell, 2014). For example, Onwuegbuzie, Gerber, and Abrams (in press) defined quantitative research as:

> The collection, analysis, and interpretation of numeric data that stem from numerous sources (e.g., standardized test scores, Likert-format scales, rating scales, self-reports, symptom checklists, personality inventories), which typically involve the generation of numbers in order to quantify certain attributes for the objective of exploring, describing, explaining, predicting, or influencing phenomena. (p. 3)

Researchers using the quantitative research approach rely on numbered data that can be analyzed using statistical procedures. Quantitative researchers tend to use a deductive inquiry approach controlling for alternative explanations so that their findings are generalizable and replicable.

Finally, the mixed methods research approach involves collecting data using both quantitative and qualitative research approaches. Many mixed methods researchers operate under the assumption that using a mixed methods research approach provides a more comprehensive understanding of a phenomenon than merely using only a qualitative or quantitative research approach (Creswell, 2014).

However, the three research approaches are not as divergent and should not be regarded as rigid or opposites (Creswell, 2014; Johnson & Onwuegbuzie, 2004). The quantitative and qualitative approaches symbolize different ends on a continuum, wherein mixed methods research lies at some point between these two poles. Some researchers prefer to collect, to analyze, and to interpret quantitative data as opposed to qualitative data and vice versa, whereas other researchers prefer to collect, to analyze, and to interpret both quantitative data and qualitative data within the same study.

In keeping with my postpositivist position (Phillips & Burbules, 2000), I selected the quantitative research approach to conduct my research investigation. When working with my students to monitor their understanding of concepts, I analyze how they arrived at their solutions by asking them why-questions and closely examining their works. Without fail, when students have made errors, they must explain their processes and rationales until they are able to reach the root cause of their errors. Postpositivists believe that causes determine effects or outcomes, and the scientific method is their accepted approach (Creswell, 2014; Phillips & Burbules, 2000).

Some postpositivists tend to begin with a theory, collect data that either substantiates or refutes the theory, and then make necessary adjustments and conduct further tests (Creswell, 2014; Phillips & Burbules, 2000). The knowledge obtained through postpositivists' perspectives comes from careful observation and measurement of the objective reality that exists in the real world (Creswell, 2014; Phillips & Burbules, 2000). Collecting numeric data of observations and studying the behavior of individuals are paramount to the postpositivist (Creswell, 2014; Phillips & Burbules, 2000). I believe that finding the underlying causes that help African American boys achieve academic success in mathematics might influence educational practices that meet the needs for this misunderstood body of students.

Falling under quantitative research studies, there are several major categories of designs. They include pre-experimental research designs, true experimental research designs, factorial designs, quasi-experimental research designs, and correlational research designs (Campbell & Stanley, 1963/2015). Pre-experimental research designs are experimental designs that involve interventions provided to a single group (Campbell & Stanley, 1963/2015; Springer, 2010). Experimental research designs involve the manipulation of one or more independent variables and the effects of that manipulation on one or more dependent variables are measured (Springer, 2010). These designs utilize random assignments where study participants have an equal and independent chance of participating in the control or the experimental group (Springer, 2010). Quasi-experimental research designs are like true experimental designs with the exception that the researchers do not have the control to randomly place study participants in a control or experimental group (Campbell & Stanley, 1963/2015; Springer, 2010). Factorial designs are experimental research designs in which the effects of two or more independent variables might have on a dependent variable are investigated (Campbell & Stanley, 1963/2015; Springer, 2010). Finally, correlational research studies are scientific studies in which researchers observe the size and direction of relationships among variables (Shadish, Cook, & Campbell, 2002; Springer, 2010). The purpose of a correlational research study is to find out whether one or more variables can predict other variables. This type study allows researchers to determine what variables might be related (Shadish et al., 2002; Springer, 2010).

In the present study, I utilized a correlational research study to investigate the relationship between African American boys' attitudes about their teacher-student relationships and their results on their mathematics achievement test. Although correlational research designs do not provide causal relationships, a correlational coefficient can be calculated to determine the strength of the association between two variables (Springer, 2010). Some research investigators approach correlational studies in two common ways (B. Thompson, Diamond, McWilliam, Snyder, & Snyder, 2005). One method is statistical testing in which rival alternatives are tested to confirm or to disconfirm the association of the variables in question. The second method is logic based and involves ruling out all reasonable alternative explanations that might impact the association between the observed variables. These rival explanations include threats to internal and external validity as mentioned in Chapter 1 of the present study. Incorporating both ways into the present study helped to substantiate the results of this study (Campbell & Stanley, 1963/2015).

This chapter contains a discussion of how the archived data from the MET project were collected and how the archived data was used in the current study. This chapter is divided up into four sections consisting of the participants, the instruments, the procedures, and the data analysis. The participant section includes information about the demographics of the participants and the number of participants involved in the study. The instrument section provides details on the Tripod Survey (also referred to as the student perception survey and the 7Cs) and the mathematics state tests administered to students in Grades 3-5. The procedure section is broken up into two parts. The first part focuses on the background data collection of the MET project. Discussion information includes the sampling process of districts, schools, teachers, and students. Information on the core design of the study in reference to the data is also provided. Moreover, information on the administration of the mathematics state test and the student perception survey is discussed. The second part of the procedure section focuses on the data collection and use for the current study. Finally, a discussion on the data analysis used in addressing each of the research questions is provided.

Participants

In this quantitative research study, archived raw data from the MET Project, a 2-year longitudinal study sponsored by the Bill and Melinda Gates Foundation (2013b), was utilized. In the first year of the MET study, six states across the United States, six large, urban school districts, 317 schools, and 2,741 teachers in Grades 4-9 teaching reading, mathematics, science, and/or social studies participated in the study from 2009 to 2010. In the second year of the MET study the number of participants was reduced.

There were 310 schools and 2,086 teachers who remained as study participants. This reduction in participants was, in part, due to a combination of schools opting out of the study, teacher attrition, illnesses, or reassignment to a grade level or subject that was not a focus of the study (Bill and Melinda Gates Foundation, 2014). Teachers participating in Year 2 of the MET Project at the elementary level comprised 582 Grades 4-5 generalist teachers who taught both ELA and mathematics, with the exception of a few teacher specialists who taught only ELA or mathematics. At the middle school level, 841 teachers in Year 2 participated in the MET study. Approximately one half of the teachers taught ELA in Grades 6-8, and the other one half of the teachers taught mathematics at the same grade levels. In Year 2 of the MET study, a total of 479 ninth-grade teachers participated. Approximately one third of them taught English, another one third taught Algebra I, and the final one third taught biology.

Moreover, a sample size of 1,333 teachers in Grades 4-8 teaching ELA and/or mathematics participated in both Year 1 and Year 2 of the MET project (Kane & Staiger, 2012). The MET project design called for the randomization of all teachers (also referred to as MET teachers), involving them being assigned to a classroom of students for the 2010–2011 school year. To begin, the MET project team collected information from all of the partner districts on their scheduling of class subjects and their methods for exchanging information about assigning teachers to courses/grade levels between schools and the district central office data system. From these meetings, the MET project team developed a plan in which schools would complete a spreadsheet with the schedule of courses taught by exchange group teachers. Next, designated school staff members from each district completed the spreadsheet independently and/or with assistance from the

MET project team when the schedules became available throughout the spring and summer of 2010. Schools received detailed written instructions on how to complete the spreadsheets. Project staff leaders also conducted webinar training for school staff on the randomization process. The training also included procedures on how to complete the spreadsheet and the process for communicating random assignments to the participating schools. Afterwards, school personnel who completed the forms independently sent the schedules to the MET project team by deadlines per each district's timelines. Finally, the MET project team processed the schedules and made random assignments.

To make these random assignments, principals set up exchange groups by identifying and placing MET teachers within each designated group. Teacher considerations for setting up these exchange groups included: (a) taught the same subject to students in the same grades; (b) held the required certification to teach the common subject area(s); and (c) agreed to teach the same subject to students in the same grade in the 2010-2011 school year. Moreover, to participate in the MET project, each exchange group needed a minimum of two teachers. In the randomization plan, MET researchers created one class roster of students for each teacher in an exchange group and randomly assigned those rosters to the exchange group teachers. Based on the grade-level classes and the subject of the exchange group, creation of randomized rosters or exchangeable rosters evolved. For instance, if the common grade-level and subject were fourth-grade ELA and mathematics, respectively, when the teacher enrolled, then only rosters for fourth-grade ELA and mathematics were a part of the randomization.

From the randomized sample, the average number of years of teaching experience by participating teachers was 10.3. Additionally, there were 453 (36.4%) teachers participating in the study with a Master's degree or higher. In this randomized sample, 1,110 (83.3%) were female teachers, whereas approximately 223 (16.7%) teachers were male. There were 757 (56.8%) White teachers, 472 (35.4%) Black teachers, 75 (5.6%) Hispanic teachers, and 29 (2.2%) other race/ethnic teachers. The characteristics of teachers in the MET sample were similar to teachers in their districts in that there was a 1% to 2% variance in characteristics, with the exception of Black and Hispanic teachers. The MET sample had the participation of 5.6% of Hispanic and 35.4 % of Black teachers in comparison to 10.8% and 26.9%, respectively, of the combined average of all non-MET teachers (Kane & Staiger, 2012). Moreover, the approximate number of teachers teaching at each grade level was as follows: 257 (19.3%) teachers taught fourth grade; 290 (21.8%) taught fifth grade; 286 (21.5%) taught sixth grade; 246 (18.5%) taught seventh grade; and 252 (18.9%) taught eighth grade (Bill and Melinda Gates Foundation, 2013b).

Students participating in the MET study were in classrooms where teachers had volunteered to be a part of the study (Kane & Staiger, 2012). From the randomized sample of 1,333 teachers who participated in both years of the study, more than 44,500 students in Grades 4-8 from their classrooms also participated on a voluntary basis. Students in MET project classrooms consisted of approximately 13,800 (31%) Hispanic students; 15,000 (33%) Black and American Indian students; and 15,000 (34%) White and Asian students. Moreover, there were approximately an equal number of male and female students. An estimated 3,500 (8%) Special Education students also participated in the MET study along with approximately 5,000 (11%) students in gifted programs and approximately 6,000 (13%) English Language Learners (ELL).

For the present, retrospective study, data from the MET project comprised 2,468 Grades 4African American boys and 2,739 Grade 5 African American boys in traditional classrooms, where teachers taught all core subject areas (i.e., mathematics, reading, language arts, science, and social studies). However, mathematics was the only subject area of focus. In addition, only archived data on those African American fourth- and fifth-grade boys who participated in the study over the 2-year period was included in the present study. The state of Texas was excluded in the present study because MET researchers only needed Grades 6-8 students at the time that the state of Texas volunteered.

Instruments

For the purpose of this study, the state assessment data files obtained in the MET study were utilized. Test scores collected over a 3-year period of the MET project included the standard and accommodated versions of each of the six states' assessments. In addition to the state assessments, archived data from the administration of the Tripod survey to students during the MET project was utilized for the present study. The Tripod survey was administered to all consenting students in class sections taught by MET teachers.

Tripod Survey. Ronald Ferguson, a researcher at Harvard University (R. Ferguson, 2012; Hanover Research, 2013), developed the Tripod survey in 2001. According to R. Ferguson (2012), the Tripod survey was refined yearly from 2001 to 2005 with the assistance of K-12 teachers in Shaker Heights, Ohio and 15 member districts of the Minority Student Achievement Network (MSAN), a national coalition of multiracial, suburban-urban school districts that have come together to understand and to eliminate achievement/opportunity gaps that persist in their schools (MSAN, 2016).

R. Ferguson (2012, p. 2) designed the Tripod survey to measure seven areas of classroom concerns that he referred to as the “Tripod 7C’s.” Presently, the Tripod survey also has become known as the Student Perception survey (Bill and Melinda Gates Foundation, 2013a; Hanover Research, 2013), with the same seven areas of classroom concerns referred to by MET researchers as the “Seven Cs (7Cs)” (Bill and Melinda Gates Foundation, 2013a, p. 29). For the purposes of the current research study and in line with the MET project, the Tripod survey and the 7Cs was used interchangeably. The classroom areas of concern were care, control, clarify (also referred to as clarity), challenge, captivate, confer, and consolidate.

Care refers to the classroom climate (Bill and Melinda Gates Foundation, 2013a; R. Ferguson, 2012). It is what teachers do to make students feel welcomed and emotionally safe to ask questions and not be afraid of making mistakes. Teachers attuned to the individualized needs of students communicate their understanding of those students and are there to support students toward their academic success (R. Ferguson, 2012). An example of a Tripod survey item measuring Care is “My teacher in this class makes me feel that he/she really cares about me” (Kane & Staiger, 2010, p. 12).

Control concerns the management of the classroom (Bill and Melinda Gates Foundation, 2013a; R. Ferguson, 2012). It is necessary for teachers to provide a learning atmosphere where students feel both physically and emotionally safe. In other words, teachers need to have the knowledge about potential off-task behaviors. They must also have a repertoire of strategies and skills in preventing off-task behaviors along with action plans for when such behaviors might occur (R. Ferguson, 2012). An example of a Tripod survey item measuring Control is "Everybody knows what they should be doing and learning in this class" (Kane & Staiger, 2010, p. 12).

Clarify refers to what teachers do during instructional time to help students grasp learning objectives being taught (Bill and Melinda Gates Foundation, 2013a; R. Ferguson, 2012). Teachers must be able to understand and to address the various needs of individual students (e.g., backgrounds, learning modalities, interests). Additionally, teachers not only need to have multiple ways of presenting information to students that engage the senses, but also, they must balance instruction to ensure that they are not exceeding students' learning capacity. An example of a Tripod survey item measuring Clarify is "If you don't understand something, my teacher explains it another way" (Kane & Staiger, 2010, p. 12).

Challenge concerns "effort and rigor—pressing students to work hard and to think hard," as explained by R. Ferguson (2012, p. 26). Teachers who challenge students promote and build endurance in students when learning difficulties arises. Also, they hold students accountable for being able to demonstrate understanding of learned objectives, to reason through thought-provoking questions, and to analyze solutions. An example of a Tripod survey item measuring Challenge is "In this class, my teacher accepts nothing less than our full effort" (Kane & Staiger, 2010, p. 12).

Captivate refers to how the teacher captures the attention of the students and keeps them engaged in the learning process (Bill and Melinda Gates Foundation, 2013a; R. Ferguson, 2012). Teachers entice students to learn with fun, interesting, and meaningful lessons and to guide them to making real world connections with the targeted learning objectives. An example of a Tripod survey item measuring Captivate is “School work is interesting” (Kane & Staiger, 2010, p. 12).

Confer concerns students’ involvement in the classroom setting (Bill and Melinda Gates Foundation, 2013a; R. Ferguson, 2012). Teachers who confer with students involve them in decision-making processes and discussions stemming from learned objectives are general classroom procedures. They model and encourage to students to share their thoughts and to communicate and learn from one another. An example of a Tripod survey item measuring Confer is “Students speak up and share their ideas about class work” (Kane & Staiger, 2010, p. 12).

Consolidate relates to how teachers check for understanding and help students organize material for more effective storing and retrieving of information (Bill and Melinda Gates Foundation, 2013a; R. Ferguson, 2012). Teachers who help students consolidate incorporate the application of summarization skills throughout each lesson. They also guide students into making connections of the newly acquired knowledge with previous learned objectives within and across various content areas. Additionally, teachers provide feedback to students on the students’ misconceptions of assigned task and on how to make improvements in their work (Kane & Staiger, 2010). An example of a Tripod survey item measuring Consolidate is “My teacher takes the time to summarize what we learn each day” (Kane & Staiger, 2010, p. 12). See Table 7 for Tripod survey items at the elementary level.

Table 7

Tripod Survey Items: Elementary

Category	Survey Questions
Care	I like the way my teacher treats me when I need help. My teacher is nice to me when I ask questions. My teacher in this class makes me feel that he/she really cares about me. If I am sad or angry, my teacher helps me feel better. The teacher in this class encourages me to do my best. My teacher seems to know if something is bothering me. My teacher gives us time to explain our ideas.
Control	My classmates behave the way my teacher wants them to. Our class stays busy and does not waste time. Students behave so badly in this class that it slows down our learning. Everybody knows what they should be doing and learning in this class.
Clarity	My teacher explains things in very orderly ways. In this class, we learn to correct our mistakes. My teacher explains difficult things clearly. My teacher has several good ways to explain each topic that we cover in this class. I understand what I am supposed to be learning in this class. My teacher knows when the class understands, and when we do not. This class is neat—everything has a place and things are easy to find. If you don't understand something, my teacher explains it another way.
Challenge	My teacher pushes us to think hard about things we read. My teacher pushes everybody to work hard. In this class we have to think hard about the writing we do. In this class, my teacher accepts nothing less than our full effort.
Captivate	School work is interesting. We have interesting homework. Homework helps me learn. School work is not very enjoyable. (Do you agree?)
Confer	When he/she is teaching us, my teacher asks us whether we understand. My teacher asks questions to be sure we are following along when he/she is teaching. My teacher checks to make sure we understand what he/she is teaching us. My teacher tells us what we are learning and why. My teacher wants us to share our thoughts. Students speak up and share their ideas about class work.

(continued)

Category	Survey Questions
	My teacher wants me to explain my answers—why I think what I think.
Consolidate	My teacher takes the time to summarize what we learn each day. When my teacher marks my work, he/she writes on my papers to help me understand.

Note. Adapted from "Learning About Teaching: Initial Findings from the Measures of Effective Teaching Project," by T. J. Kane and D. O. Staiger, 2010. Copyright 2010 by The Bill and Melinda Gates Foundation. Adapted with permission. (See Appendix F.)

State tests. As previously stated, the archived mathematics assessment data from the MET project was utilized in this study. These data files consisted of students' test results from the states of Colorado, Florida, New York, North Carolina, and Tennessee. Under the NCLB Act of 2001, states were mandated to test students in reading and mathematics in Grades 3-8 and once in high school to receive federal funding for their educational programs (Klein, 2016). Another requirement of the law was for states to bring all students to the proficient level on state tests by the 2013-2014 school year (Klein, 2016). Test results of schools receiving federal funds were reported annually and monitored through the AYP system to track progress or lack of progress toward meeting the proficient level. The state assessments were used to measure the degree to which students had learned and were able to use the pre-determined knowledge and skills at each tested grade level (Colorado Department of Education [CDOE], 2010, 2011; Florida Department of Education [FDOE], 2010, 2012; New York State Education Department [NYSED], 2010, 2011; North Carolina Department of Public Instruction [NCDOPI], 2008); Tennessee Department of Education [TDOE], 2010, 2011). The tested areas in the Grades 3-5 mathematics curriculum common to all state assessments comprised the following six standards: numbers and operations, algebra, geometry, measurement, data analysis and probability, and process standards (CDOE, 2010, 2011; FDOE, 2010, 2012; NYSED, 2010, 2011; NCDOPI, 2008; TDOE, 2010, 2011). NCTM (2016a) further breakdowns each strand into standards and expectations.

In the numbers and operations standards, there were three areas for which students had to demonstrate mastery. The first area was for students to understand numbers, ways of representing numbers, relationships among numbers, and number systems. The second area was for students to understand the meanings of the operations (i.e., addition, subtraction, multiplication, division) and their relationship to one another. The third area was for students to perform computations fluently and to make reasonable estimates.

In the algebra standards, there were four areas for which students had to demonstrate mastery. The first area was for students to understand patterns, relations, and functions. The second area was for students to represent and to analyze mathematical situations and structures using algebraic symbols. The third area was for students to use mathematical models to represent and to understand quantitative relationships. The fourth area was for students to analyze change in various contexts.

In the geometry standards, there were also four areas for which students had to demonstrate mastery. The first area was for students to analyze characteristics and properties of two- and three- dimensional geometric shapes and to develop mathematical arguments about geometric relationships. The second area was for students to specify locations and to describe spatial relationships using coordinate geometry and other representational systems. The third area was for students to apply transformations and to use symmetry to analyze mathematical situations. Finally, the fourth area was for students to use visualization, spatial reasoning, and geometric modeling to solve problems.

In the measurement standards, there were only two areas for which students had to demonstrate mastery. The first area was for students to understand measurable attributes of objects and the units, systems, and processes of measurement. The second area was for students to apply appropriate techniques, tools, and formulas to determine measurements.

In the data analysis and probability standards, again, there were four areas for which students had to demonstrate mastery. The first area was for students to formulate questions that could be addressed with data and then collect, organize, and display relevant data to answer the formulated questions. The second area was for students to select and to use appropriate statistical methods to analyze data. The third area was for students to develop and to evaluate inferences and predictions that were based on the data. Finally, the fourth area was for students to understand and to apply basic concepts of probability.

In the process standards, there were another five areas for which students had to demonstrate mastery. The first area was for students to be able to problem solve by using new mathematical knowledge, applying appropriate strategies, and reflecting on the mathematical problem solving process. The second area was for students to be able to reason and to provide proof of solutions to answers arrived through problem solving. The third area was for students to be able to communicate their mathematical thinking to solidify concepts and to analyze and to evaluate the mathematical thinking and strategies of others. The fourth area was for students to be able to make connections among mathematical ideas and to apply mathematics in various contexts. Finally, the fifth area was for students to be able to use representation for organizing, recording, and communicating mathematical ideas. Additionally, students were expected to be able to select, to apply, and to translate mathematical representations to solve problems. Please see Table 8 for mathematics expectations of students in Grades 3-5.

Table 8

NCTM's Strands, Standards, and Expectations for Grades 3-5 Mathematics

Strand	Standard	Expectation
Numbers and Operations Standards(continued)	Understand numbers, ways of representing numbers, relationships among numbers, and number systems.	Understand the place-value structure of the base-ten number system and be able to represent and compare whole numbers and decimals.
		Recognize equivalent representations for the same number and generate them by decomposing and composing numbers.
		Develop understanding of fractions as parts of unit wholes, as parts of a collection, as locations on number lines, and as divisions of whole numbers.
		Use models, benchmarks, and equivalent forms to judge the size of fractions.
		Recognize and generate equivalent forms of commonly used fractions, decimals, and percent.
		Explore numbers less than 0 by extending the number line and through familiar applications.
		Describe classes of numbers according to characteristics such as the nature of their factors.

(continued)

Strand	Standard	Expectation
	Understand meanings of operations and how they relate to one another.	Understand various meanings of multiplication and division.
		Understand the effects of multiplying and dividing whole numbers.
		Identify and use relationships between operations, such as division as the inverse of multiplication, to solve problems.

		Understand and use properties of operations, such as the distributivity of multiplication over addition.
	Understand meanings of operations and how they relate to one another.	Develop fluency with basic number combinations for multiplication and division and use these combinations to mentally compute related problems, such as 30 × 50.
		Develop fluency in adding, subtracting, multiplying, and dividing whole numbers.
		Develop and use strategies to estimate the results of whole-number computations and to judge the reasonableness of such results.
		Develop and use strategies to estimate computations involving fractions and decimals in situations relevant to students' experience.
		Use visual models, benchmarks, and equivalent forms to add and subtract commonly used fractions and decimals. Select appropriate methods and tools for computing with whole numbers from among mental computation, estimation, calculators, and paper and pencil

(continued)

Strand	Standard	Expectation
		according to the context and nature of the computation and use the selected method or tools.
Algebra Standards	Understand patterns, relations, and functions	Describe, extend, and make generalizations about geometric and numeric patterns.
		Represent and analyze patterns and functions, using words, tables, and graphs.
	Represent and analyze mathematical situations and structures using algebraic symbols.	Identify such properties as commutativity, associativity, and distributivity and use them to compute with whole numbers.
		Represent the idea of a variable as an unknown quantity using a letter or a symbol.
		Express mathematical relationships using equations.
	Use mathematical models to represent and understand quantitative relationships.	Model problem situations with objects and use representations such as graphs, tables, and equations to draw conclusions.
	Analyze change in various contexts.	Know how a change in one variable relates to a change in a second variable. Identify and describe situations with constant or varying rates of change and compare them.

(continued)

Strand	Standard	Expectation
Geometry Standards	Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.	Identify, compare, and analyze attributes of two- and three-dimensional shapes and develop vocabulary to describe the attributes. Classify two- and three-dimensional shapes according to their properties and develop definitions of classes of shapes such as triangles and pyramids. Investigate, describe, and reason about the results of subdividing, combining, and transforming shapes.
	Specify locations and describe spatial relationships using coordinate geometry and other representational systems.	Explore congruence and similarity. Make and test conjectures about geometric properties and relationships and develop logical arguments to justify conclusions. Describe location and movement using common language and geometric vocabulary. Make and use coordinate systems to specify locations and to describe paths. Find the distance between points along horizontal and vertical lines of a coordinate system.

(continued)

Strand	Standard	Expectation
	Apply transformations and use symmetry to analyze mathematical situations.	Predict and describe the results of sliding, flipping, and turning two-dimensional shapes.
		Describe a motion or a series of motions that will show that two shapes are congruent.
		Identify and describe line and rotational symmetry in two- and three-dimensional shapes and designs.
	Use visualization, spatial reasoning, and geometric modeling to solve problems.	Build and draw geometric objects.
		Create and describe mental images of objects, patterns, and paths.
		Identify and build a three-dimensional object from two-dimensional representations of that object.
		Identify and draw a two-dimensional representation of a three-dimensional object.
		Use geometric models to solve problems in other areas of mathematics, such as number and measurement.
		Recognize geometric ideas and relationships and apply them to other disciplines and to problems that arise in the classroom or in everyday life.

(continued)

Strand	Standard	Expectation
Measurement Standards	Understand measurable attributes of objects and the units, systems, and processes of measurement.	Understand such attributes as length, area, weight, volume, and size of angle and select the appropriate type of unit for measuring each attribute.
		Understand the need for measuring with standard units and become familiar with standard units in the customary and metric systems.
		Carry out simple unit conversions, such as from centimeters to meters, within a system of measurement.
		Understand that measurements are approximations and how differences in units affect precision.
		Explore what happens to measurements of a two-dimensional shape such as its perimeter and area when the shape is changed in some way.
	Apply appropriate techniques, tools, and formulas to determine measurements.	Develop strategies for estimating the perimeters, areas, and volumes of irregular shapes.
		Select and apply appropriate standard units and tools to measure length, area, volume, weight, time, temperature, and the size of angles.

(continued)

Strand	Standard	Expectation
		Select and use benchmarks to estimate measurements.
		Develop, understand, and use formulas to find the area of rectangles and related triangles and parallelograms.
		Develop strategies to determine the surface areas and volumes of rectangular solids.
Data Analysis and Probability Standards	Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.	Design investigations to address a question and consider how data-collection methods affect the nature of the data set.
		Collect data using observations, surveys, and experiments.
		Represent data using tables and graphs such as line plots, bar graphs, and line graphs.
		Recognize the differences in representing categorical and numerical data.
	Select and use appropriate statistical methods to analyze data.	Describe the shape and important features of a set of data and compare related data sets, with an emphasis on how the data are distributed.
		Use measures of center, focusing on the median, and understand what each does and does not indicate about the data set.
		Compare different representations of the same data and evaluate how well each representation shows important aspects of the data.
	Develop and evaluate inferences and predictions that are based on data.	Propose and justify conclusions and predictions that are based on data and design studies to further investigate the conclusions or predictions.

(continued)

Strand	Standard	Expectation
	Understand and apply basic concepts of probability.	Describe events as likely or unlikely and discuss the degree of likelihood using such words as certain, equally likely, and impossible.
		Predict the probability of outcomes of simple experiments and test the predictions.
		Understand that the measure of the likelihood of an event can be represented by a number from 0 to 1.
Process Standards	Problem Solving	Build new mathematical knowledge through problem solving.
		Solve problems that arise in mathematics and in other contexts.
		Apply and adapt a variety of appropriate strategies to solve problems.
		Monitor and reflect on the process of mathematical problem solving.
	Reasoning and Proof	Recognize reasoning and proof as fundamental aspects of mathematics.
		Make and investigate mathematical conjectures.
		Develop and evaluate mathematical arguments and proofs.
		Select and use various types of reasoning and methods of proof.
	Communication	Organize and consolidate their mathematical thinking through communication.

(continued)

Strand	Standard	Expectation
		Analyze and evaluate the mathematical thinking and strategies of others.
		Use the language of mathematics to express mathematical ideas precisely.
		Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.
	Connections	Recognize and use connections among mathematical ideas.
		Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.
		Recognize and apply mathematics in contexts outside of mathematics.
	Representation	Create and use representations to organize, record, and communicate mathematical ideas.
		Select, apply, and translate among mathematical representations to solve problems.

Note: Adapted from *"Principles and Standards for School Mathematics*." (See Appendix G.)

Additionally, the test scores of students who participated in the accommodated/modified versions of each state's assessment were utilized in the MET project. The accommodated/modified version of the state assessments are shortened versions of the standard state assessments that do not include the field test questions and allow for accommodations (e.g., larger print, oral administration, use of manipulatives, small groups). The score validity and score reliability of the administered state tests also were monitored and assessed by each state's educational department (CDOE, 2010, 2011; FDOE, 2010, 2012; NYSED, 2010, 2011; NCDOPI, 2008; TDOE, 2010, 2011).

Validity. The validity of each state's mathematics scores was content-based and tied directly to the specific statewide curriculum for that state through the test development process (CDOE, 2010, 2011; FDOE, 2010, 2012; NYSED, 2010, 2011; NCDOPI, 2008; TDOE, 2010, 2011). The purpose of test validation is not to validate the test itself, but to validate interpretations of the test scores for particular purposes or uses (CDOE, 2010, 2011; FDOE, 2010, 2012; NYSED, 2010, 2011; NCDOPI, 2008; TDOE, 2010, 2011). The validity evidence based on test content supports the assumption that the content of the test adequately measures the intended construct (CDOE, 2010, 2011; FDOE, 2010, 2012; NYSED, 2010, 2011; NCDOPI, 2008). Although test validation is not solely a quantifiable property, validating assessments is an ongoing process, from the initial construction and continuing throughout the lifetime of the assessment. Every aspect of an assessment provides evidence in support of its score validity (or evidence to the contrary), including design, content specifications, item development, and psychometric quality (CDOE, 2010, 2011; FDOE, 2010, 2012; NYSED, 2010, 2011; NCDOPI, 2008; TDOE, 2010, 2011). When the state assessments were designed as the standards-referenced assessment for the state curriculum, various professionals (e.g., educators across the state, test developers, test experts) were brought together and committees were formed to develop subject area tests. These content area tests then were administered by subject area and grade level to students through a field test. Afterwards, the established committees reviewed test items for content, bias, and data from the field-testing (CDOE, 2010, 2011; FDOE, 2010, 2012; NYSED, 2010, 2011; NCDOPI, 2008; TDOE, 2010, 2011).

Reliability. Each state's test comprised multiple-choice and short-answer items. The different states used various methods for estimating score reliability with a mixture of item types. The reliability of students' scores is considered to be high when it is in the range of 0.80 and above (CDOE, 2010, 2011; FDOE, 2010, 2012; NYSED, 2010, 2011; NCDOPI, 2008; Onwuegbuzie & Daniel, 2002, 2004; TDOE, 2010, 2011; B. Thompson & Vacha-Haase, 2000; Vacha-Haase, Kogan, & Thompson, 2000; Witta & Daniel, 1998). The stratified coefficient alpha, also known as the extended Cronbach's alpha, was used by TDOE (2010, 2011) for estimating score reliability of the mixture of item types on the Tennessee Comprehensive Assessment Program (TCAP) test. Additionally, TDOE utilized the Kuder-Richardson 20 (KR20) reliability formula that is used for tests with only multiple-choice items (TDOE, 2010, 2011). In Appendix J of Chapter 9 (TDOE, 2010, 2011), the reliability coefficient of .93 was constant for all three grade-level mathematics scores.

In assessing the score reliability of the New York State Testing Program tests (NYSTP), NYSED (2010, 2011) utilized two reliability coefficients—the Cronbach's alpha and Feldt-Raju (appropriate for multiple-choice and constructed-response tests)—for Grades 3-8 Mathematics sub-tests. The calculated Cronbach's alpha and Feldt-Raju score reliability coefficients ranged from .91 to .94 for the 2009-2010 administration of the NYSTP tests (see Table 42 of Section VIII (NYSED, 2010). The calculated Cronbach's alpha and Feldt-Raju reliability coefficients ranged from .91 to .94 for the 2010-2011 administration (refer to Table 38 of Section VII (NYSED 2011).

FDOE employed Cronbach's alpha and the Item Response Theory (IRT) model-based coefficients, also known as marginal reliability coefficients, for the Florida Comprehensive Assessment Test (FCAT) administered during the 2009-2010 school year (FDOE, 2010). The marginal reliability coefficient, like the Cronbach's alpha, is appropriate when a test consists of one item type (FDOE, 2010). The reliability coefficient for all three grade level mathematics scores for the 2009-2010 school year ranged from .89 to .93 (refer to Table 35 of 2010 FCAT Test-level Statistics Section, FDOE, 2010). During the 2010-2011 school year, FDOE (2011) transitioned to the FCAT 2.0 (FDOE, 2011) and utilized Cronbach's alpha, the marginal reliability, the stratified alpha, and the Feldt-Raju coefficients. The score reliability coefficient for the 2010-2011 school year was .92 to .93 (refer to Cronbach Alpha and Marginal Reliability: Mathematics Table of the Mathematics Section and Feldt-Raju and Stratified Reliability for MC and GR Item Types: Mathematics Table, FDOE, 2011).

Moreover, for the Colorado Student Assessment Program (CSAP) tests, the CDOE utilized Cronbach's alpha reliability coefficient (CDOE, 2010, 2011). As shown in Table 221 of Part 8 (CDOE, 2010, 2011), the Colorado Student Assessment Program (CSAP) Test score reliability coefficient of .91 to .94 was constant for both school years.

Additionally, for the End-of-Grade (EOG) assessments, NCDOPI employed Cronbach's alpha for testing for internal consistency during the 2007-2008 administration of the EOG (NCDOPI, 2008). In Table 29 of Chapter 6 (NCDOPI, 2008), the score reliability coefficient ranged from .91 to .92. These same score reliability coefficients also were applied to the administrations of EOGs during the 2009-2010 and 2010-2011 school years. Please see Table 9 or the reliability coefficients of each state's test administered to Grades 3-5 students.

Table 9

Reliability Coefficients for Each State's Test Administered to Grades 3-5 Students

State Education Department	Achievement Test	Reliability Coefficients	Grade	Reliability Coefficient Range 2009-2010 and 2010-2011
Colorado Department of Education	Colorado Student Assessment Program (CSAP)	Cronbach's Alpha	Third	.91 - .91
			Fourth	.94 - .94
			Fifth	.94 - .94
Florida Department of Education	Florida Comprehensive Assessment Test/ Florida Comprehensive Assessment Test (FCAT) 2.0	*Cronbach's alpha, Item Response Theory, Stratified alpha, and Feldt-Raju	Third	.90 - .93
			Fourth	.89 - .92
			Fifth	.92 - .93
New York State Education Department	New York State Testing Program (NYSTP)	**Cronbach's alpha and Feldt-Raju	Third	.88 - .91
			Fourth	.94 - .94
			Fifth	.90 - .91
North Carolina Department of Public Instruction	North Carolina End of Grade (EOG)	***Cronbach's alpha	Third	.91
			Fourth	.92
			Fifth	.92
Tennessee Department of Education	Tennessee Comprehensive Assessment Program (TCAP)	****Stratified coefficient alpha and KR-20	Third	.93 - .93
			Fourth	.92 - .93
			Fifth	.93 - .93

Note. **All reliability coefficients had variations ranging from .1 to .2.*

**Cronbach's alpha and Feldt-Raju had variations ranging from.01 to .03.

****Reliability coefficients reflect the reliability test conducted in 2008 and applied to the administrations of EOGs during the 2009-2010 and 2010-2011 school years.*

***** The stratified coefficient and KR-20 had a variation of .01.*

Procedure

As mentioned previously, archived data from the MET study was utilized in the present study. Procedures for conducting this study followed the requirements and Data Security Plan (DSP) in the Agreement for the Use of Confidential Data from the Measures of Effective Teaching Longitudinal Database at the Inter-university Consortium for Political and Social Research [ICPSR] (n.d.). Background information on data collected from the MET study was used in the current study is discussed. Afterwards, the course of action for the present study is provided.

Background of MET study data collection. The MET project was the largest study of classroom teaching undertaken by researchers in the history of the United States. MET researchers collected a variety of teaching quality indicators over a 2-year period (2009-2010 and 2010-2011) in the classrooms of more than 2,500 fourth- through ninth-grade teachers. Information pertaining to the sampling of participants, the randomization process, and the administration of the student perception surveys and mathematics state test shared in this section comes from the Measures of Effective Teaching: 1 - Study Information (Bill and Melinda Gates Foundation, 2013a). The Research questions used to guide the study by MET researchers were as follows:

- How reliable and valid are the specific measures of teaching effectiveness under study? Do the various measures identify distinctive dimensions of teaching effectiveness, and if so, what dimensions are identified? What measures of effective teaching are empirically related to student learning gains?

- What does effective teaching look like, and how does it compare to less effective teaching? For example, what is the distribution of teacher scores on measures of effective teaching, and how much difference is there in teacher knowledge scores, teaching practice scores, and student outcome scores among teachers at different points in the distribution of measures of effective teaching?
- Can multiple sources of data on teachers and their teaching be combined to develop a set of fair, valid, and reliable indicators of teaching quality for use in teacher evaluation systems intended to rank teachers for personnel decision making and to promote teachers' professional learning and development? (Bill and Melinda Gates Foundation, 2013a, p. 5)

The information collected on the MET teachers and their teaching included various data. One type of data was the measures of students' achievement in the MET teachers' classroom retrieved from state-administered assessments and supplemental achievement tests. Another type of data collected was from the students' survey results in the MET teachers' classes.

Additionally, video-recorded lessons taught by MET teachers and scored by independent observers using multiple classroom observation protocols also was collected. Other information collected was assessments of the MET teachers' pedagogical and content knowledge for teaching and two different teacher surveys. Moreover, MET principals also completed surveys. Although MET researchers in the original study collected numerous data, the information collected from the MET project over the 2-year period for sampling, data collection, instrumentation, and data analysis was limited to the relevant information required for the current study.

Sampling process. In Year 1 (2009-2010) of the MET project, the researchers began with opportunity sampling that took place from July to November 2009. As mentioned earlier, six large school districts volunteered to participate in the study. The districts selected to participate in the study were as follows: Charlotte-Mecklenburg Schools—North Carolina; Dallas Independent School District—Texas; Denver Public Schools—Colorado; Hillsborough County Public Schools—Florida; Memphis City Schools—Tennessee; and the New York City Department of Education—New York.

Districts. These districts were receiving support from the Gates Foundation to develop human resource systems or had worked previously with the Gates Foundation. Additional requirements for the districts to participate in the MET project included the district's interest in the study, adequate staff size to assure sufficient numbers of teacher volunteers, and central office support. These districts also had to have the capacity and willingness to participate in all parts of the data collection process and to participate in regular MET meetings with other participating districts and MET researchers. Moreover, these districts had to have local political and union support for the MET project. Participating districts received grant funding from the Gates Foundation that allowed for the hiring of at least one full-time district-level project coordinator.

Schools. The process of opportunistic sampling then continued as elementary, middle, and high schools within each MET district were recruited into the study. Only schools that had more than one teacher in Grades 4-9 teaching the same subject (a grade/subject combination) were selected to participate in the study because MET researchers planned to form exchange groups in Year 2 of the study. However, in every district, certain schools were excluded from participation in the MET study. The schools excluded were special education schools, alternative schools, community schools, dropout and pregnancy programs, returning education schools, and non-academic vocational schools. Additionally, schools that practiced team teaching were excluded because assignment of responsibility for a student's learning to a single, specific teacher would not have been possible. A standard letter describing the project was sent to all eligible schools within each participating district. The assigned district coordinators in each of the districts then held informational meetings and encouraged principals to take part in the study. Principals who agreed to participate in the project completed an online sign-up form through which they provided general information about their school and the teachers in the school. Also, they agreed to participate in all aspects of data collection and to randomly assign teachers to classrooms during Year 2 of the MET study. Several incentives were offered to schools to participate in the MET project. Schools received $1,500 for use at the principal's discretion. They received further payment of $500 per year for a school project coordinator. Lastly, the video recording equipment required for the classroom observation component of the MET Study was donated to the school at the conclusion of the study.

Teachers. Once schools had been recruited, opportunity sampling continued as Grades 3-8 mathematics and ELA teachers within the participating schools volunteered for the study. Teachers at MET schools were invited to participate in the study; however, some exclusions were made. Teachers who were team teaching or looping were omitted from the study because the assignment of responsibility for the learning of a given student in a specific subject to that teacher would have been impossible. Additionally, teachers who indicated that they were not planning to stay in the same schools and teach the same subjects the following year were not invited to participate in the study because they would not have been available for the duration of the study. Finally, as previously mentioned, when there were less than two other teachers with the same grade/subject teaching assignments, teachers were excluded because there was a representative number to form exchange groups. Teachers who agreed to participate in the study also agreed to have their classroom instructions observed and videotaped. All teachers who met the selection requirements were mailed a standard invitation to participate in the MET project. These teachers were encouraged to participate by their school principals, school-level coordinators, and the district coordinators. In the MET schools, teachers who were selected for study received a $1,500 incentive for their participation ($1,000 at the beginning and $500 at the end of the study). Moreover, the districts also were awarded small budgets to provide thank you gifts for participating teachers in the study. The sampling process resulted in 2,741 teachers from 317 schools in six large school districts being recruited into the first year of the study.

Students. The selection of teachers and their observed class sections yielded the student sample for the study. After students had been identified, efforts were made by the MET researchers to include all students from each classroom selected for study. Students enrolled in MET teachers' classrooms received informational fliers and consent forms to take home to their parents. With the exception of Hillsborough, parents had the opportunity to remove their children from the study. In Hillsborough County Public Schools, students were required to bring in signed permission slips to be included as part of the study. Students who opted out of participating in the MET study did not take the student survey or supplemental assessments administered as part of the study. Additionally, during video recording of classroom instruction, non-participating students sat in a specific section of the room that was not video recorded. However, administrative data on student background and state assessment scores for all students in MET teachers' focal classes were obtained and used in the study.

Core design. The MET researchers investigated issues of teaching effectiveness within a central set of grades and subjects. At the elementary grades, the MET researchers focused on the teaching of ELA and Mathematics at Grades 4 and 5. Of the fourth- and fifth-grade teachers recruited into the study, a large number of MET teachers were subject-matter generalists who taught ELA and Mathematics to a single class of students. However, a smaller number of teachers at Grades 4 and 5 were either subject matter specialists (who taught ELA or Mathematics to more than one class section of students) or teachers who only volunteered to have their teaching of a single subject studied.

Moreover, MET researchers video recorded teachers on 4 different days. These video recordings occurred between February 2010 and June of 2010 in Year 1 of the study and between October 2010 and June 2011 in Year 2 of the study. The recording of MET teachers was spread out within the mentioned time periods in an attempt to assure that lessons were more representative of instruction. The video recordings on each of the 4 days included an ELA and a mathematics lesson taught at different times during the same day of each recording. Grades 4-5 teacher specialists who taught the same subject to several groups of students also were video-recorded as they provided instruction in two of their class sections. Both class sections of the teacher specialists were video recorded on the same day. Although, the teacher specialists only participated in 2 days of video recording sessions, they still had a total of four taped videos for their specialized content area like the generalist teachers. Additionally, video recordings of all MET teachers included two assigned topics by the MET researchers and two topics of teachers' choices.

Additionally, the MET teachers were trained and were responsible for all video recordings as well as for uploading videos to a secure website. A specially designed camera set-up was used for the recording. Each set-up had two cameras: one focused on the board, the other providing a 360-degree classroom view. The camera set-up also included two wireless microphones, one to capture the teachers' voice and the other to capture students' voices. These captured videos were uploaded, and research partners combined the separate video and audio channels into one video. Afterwards, the videos were made available to the teachers who were required to check their videos for accuracy and to upload students' work, students' assignments, lesson plans, and written commentaries on the lessons.

In Year 2, all of the 582 participating teacher volunteers were observed using similar video recording and scoring procedures used in Year 1. Additionally, some data collections were continued, including collection of district administrative data on students, administration of student assessments, and administration of the student survey. Moreover, the randomization process was introduced into the study in Year 2. As described earlier, in the randomization process, classes of students were assigned randomly to teacher volunteers participating in the MET project to minimize threats to validity. At least two members of an exchange group had to be teaching at the same school at the time of randomization for teachers to be randomized and included in the core study.

Administration of student test and perception survey. Procedures for student testing remained the same across both years of the MET study. The MET researchers measured student learning in Grades 4-5 using state assessments in reading and mathematics and two assessments administered directly by MET researchers—the Stanford Achievement Test (SAT) 9 Open-Ended Reading Assessment, and the Balanced Assessment in Mathematics (BAM). For the current study, only the statement assessments were utilized.

Moreover, MET researchers also administered the Student Perception (Tripod or 7Cs) Survey to students in Grades 4-5. In classes for generalist teachers, a randomly selected one half of the class completed the survey while thinking about their ELA class and the other one half completed the survey while thinking about the mathematics class. As previously mentioned, during Year 1 only, students reported on their college aspirations and how often they read at home. During Year 2 only, scales were added to the survey to measure characteristics of the classroom beyond the 7Cs. In the present study, the focus was on the 7Cs, and the added questions from Year 1 and Year 2 were not included.

Data collection and use for current study. Because I used archived data, I requested an exemption from Sam Houston State University's Institute Review Board (IRB). The confidential data request was solely used for research and statistical purposes relative to the current study—to determine whether there is a relationship between fourth- and fifth-grade African American boys' attitudes of teacher-student relationships and their mathematics achievement. In accessing data files from the MET study, stipulations had to be met (ICPSR, n.d.). First, the requesting institution had to be an institution of higher education, a research organization, a research arm of government agency, or a nongovernmental, not for profit, agency. Additionally, the institution had to have a demonstrated record of using confidential data according to commonly accepted standards of research ethics and applicable statutory requirements. Another requirement was that a primary investigator from the requesting institution had to be in charge of overseeing team members' use of the confidential data. The primary investigator had a Ph.D. and held a faculty at Sam Houston State University. My proposal chairperson, Dr. Anthony Onwuegbuzie served as the primary investigator, and I served as the researcher. Together, we were referred to as the project team. We did not attempt to use the requested data for any other purpose outside the scope of this study without the prior consent of ICPSR. Additionally, we made no attempt to identify private person(s) and no confidential data of private person(s) were published or distributed in any manner. Moreover, the confidential data was protected against deductive disclosure risk by strictly adhering to the obligations set forth in the agreement with ICPSR. Further, precautions to protect the confidential data from non-authorized use were taken. Once I received IRB approval, the steps to access and to protect participant's data was followed as described below per the ICPSR (n.d.).

1. A Restricted Data Contracting System (RDCS) online application for obtaining confidential data was completed and submitted along with the DSP to ICPSR.

2. Adherence to the compliance of the approved DSP relevant to the agreement with ICPSR was adhered to at all times. The DSP was as follows:
    a. In keeping with ICPSR's DSP, the computer used to access the MET Longitudinal Database was password protected.
    b. As the project team, we did not share or give our MET username and password to anyone or each other including Sam Houston State University's Instructional Technology (IT) staff. Further, the project team did not store passwords on the computer in electronic or written form, and we did not use software password storage programs to save passwords.
    c. The project team contacted ICPSR staff with questions that arose concerning the MET Longitudinal Database or any confidential data. Contact with the Sam Houston State University IT team while installing the VM client software to access the MET Longitudinal Database was not necessary in that the project team was able to download the software with no difficulties and set up a second passcode using their smartphones as security in accessing the data.
    d. No unauthorized person(s) was allowed to access or to view confidential data within the MET Longitudinal Database.
    e. No unauthorized person(s) was allowed to be inside the Secure Project Office when an authorized project team member was logged into the MET Longitudinal Database.

f. MET Longitudinal Database content was not displayed on the computer monitor to any unauthorized person(s). The computer monitor display screen was not visible from open doors or through windows.

g. The computer was set to activate a password protected screen saver after 3 minutes of inactivity.

h. When the project team members were logged into the Met Longitudinal Database and left the computer, we disconnected or logged off from the MET Longitudinal Database.

i. The project team kept keep all confidential data within the Met Longitudinal Database. We did not duplicate or copy the data (e.g., retype, non-technical ways of copying). No screenshots, photographs, or videos of the displayed confidential data or statistical outputs were taken. There was no typing or recording of the confidential data or results from the data onto our PC or some other device or media.

j. All hardcopy documents related to the confidential data such as research notes were protected by being kept in a locked cabinet when not in use.

k. No discussions about confidential data or results from the MET Longitudinal Database took place in non-secure or public locations by any member of the project team prior to a disclosure review and approval by ICPSR. Further, discussions did not occur where unauthorized person(s) could eavesdrop.

l. The project team submitted all statistical outputs/results from the MET Longitudinal Database to ICPSR for a disclosure review prior to sharing or to giving such outputs to unauthorized person(s). Outputs were revised or altered as required by ICPSR in order to minimize disclosure risk to ICPSR approving these outputs for dissemination to unauthorized persons.

m. Only aggregated information from the confidential data to unauthorized persons after the project team had obtained clearance through the ICPSR disclosure process were disseminated.

n. The project team members included in the Use of Confidential Data from the MET Longitudinal Database at ICPSR Agreement used the data on a computer in a Secure Project Office. The researcher used a laptop to access the confidential data. The Secure Project Office was set up in both the homes of the primary investigator and the researcher. When the data were being used, the screen was not visible from the doorway or windows. The door was closed and only individual(s) approved to work with the data will was in the room. The office door was locked when the data windows were active and team members were out of their offices.

3. As mentioned previously, the primary investigator, Dr. Onwuegbuzie, and the researcher, Corina Bullock, as identified in the agreement were the sole persons who had access to the contents of confidential data files or any files derived from confidential data files.

4. Data obtained from the confidential data files were not disclosed or made available to current and former employees of the Charlotte-Mecklenburg Schools, Dallas Independent School District, Denver Public Schools, Hillsborough County Public Schools, Memphis City Schools, and New York

City Department of Education (school districts). The project team had no current or past affiliations with the school districts; therefore, making any disclosures about affiliations with the school districts to ICPSR unnecessary.

5. There was no breach in unauthorized access, use, or disclosure of confidential data or access, use, or disclosure of confidential data that was inconsistent with the terms and conditions of the agreement with ICPSR.
6. The project team made no attempt to link the confidential data to any individuals, whether living or deceased. Additionally, there was no linkage of confidential data to any other dataset, including datasets provided by ICPSR.
7. The project team referred to the Checklist on Disclosure Potential of Data (Bureau of Census) to avoid inadvertent disclosure of private persons by being knowledgeable about what factors constituted disclosure risk and by using disclosure risk guidelines on data retrieved from the confidential data files. Please refer to the agreement in Appendix H.
8. The identity of any private person(s) was not discovered.

Data Analysis

The following research questions guided this study:

1. What is the relationship between fourth-grade African American boys' attitudes toward teacher-student relationships and their mathematics achievement?

2. What is the relationship between fifth-grade African American boys' attitudes toward teacher-student relationships and their mathematics achievement?

In addressing Research Questions 1 and 2, a multiple regression analysis was conducted. Additionally, effect sizes were computed, reported, and interpreted.

Multiple regression analysis. As noted previously, in addressing Research Questions 1 and 2, the statistical method utilized was multiple regression. When a researcher is investigating the relationship of two or more independent (also referred to as predictors) continuous variables with the outcome of one dependent (also referred to as the criterion variable) continuous variable, multiple regression analysis is best suited for this purpose (Creswell, 2014; Springer, 2010). In the current study, archived data from the MET Longitudinal Database was used—more specifically the Core files. The independent continuous variables came from the 7Cs survey and comprised: care, control, clarify, challenge, captivate, confer, and consolidate. The dependent variable in this study was the mathematics state test scores. Several assumptions for multiple regression models were met prior to being appropriately applied to the population of interest in that the coefficients and parameters of the regression equation were not influenced by one another. According to Field (2009), the following assumptions must be taken into account:

- All predictor variables must be quantitative or categorical and the outcome variable must be quantitative, continuous, and unbounded.
- The independent variables should have some variation in value, no zero variances.
- There should be no perfect linear relationship or multicollinearity between two or more of the independent variables.
- There should be no external variables included in the regression model that correlate with any of the variables included in the regression model.

- At each level of the independent variables, the variance of the residual terms should be constant or have the same variance known as homoscedasticity. Heteroscedasticity are unequal variances that should not be present.
- Errors, wherein any two observations are dependent of each other, should not be present.
- Normally distributed errors should be present such that the residuals in the model represent random, normally distributed variables with a mean of zero or close to zero.
- Independence of all the values of the dependent variable is expected.
- There is a linear relationship between the mean values of the dependent variable for each increment of the independent variables.

In conducting the data analysis using SPSS, the following statistical data were computed to meet the previously discussed assumptions and to determine the parameters:

1. By using descriptives, the mean and standard deviation of each variable in the dataset and the average number of participants were calculated. Additionally, a correlation matrix was included to show the value of Pearson's correlation coefficient between every pair of variables, thereby revealing whether there is a positive or negative correlation. Included in the correlation matrix were the two-tailed probability significance of each correlation and the number of corresponding cases contributing to each correlation (Field, 2009). According to Field (2009), the correlation matrix is used to determine a "general idea of the relationships between predictors and the outcome, and for a preliminary look for multicollinearity. If there is no multicollinearity in the data then there

should be no substantial correlations using Pearson's correlation coefficient (*r* >.9) between predictors" (p. 233). The Pearson's correlation coefficient is indicative of the overall fit of the regression model (Field, 2009).

2. The model fit or line of best fit was used to determine whether the model had the ability to predict the dependent variable. The *F* ratio, which is the measure of how much the model has improved the prediction of the dependent variable compared to the level of inaccuracy of the model, was also determined. The values of *R* (multiple *R*), the corresponding R^2, and the adjusted R^2 also were calculated (Field, 2009). R^2 represents the amount of variance in the dependent variable explained by the model relative to how much variation there was to explain initially from the independent variables and was used to estimate the substantive size of the relationship. Information on the generalizability of the model was determined from the adjusted R^2. *R* is the multiple correlation coefficient between the independent variables and the dependent variables (Field, 2009).

3. The *R* squared change was computed to show the change in R^2 resulting from the addition of new independent variables.

4. By using the estimates, information was obtained on the estimated coefficients of the regressions or *b* values. Moreover, test statistics and their significance were calculated for each regression coefficient. Further, a *t* test was used to determine whether each *b* coefficient differs significantly from zero (Field, 2009).

5. Data from confidence intervals were obtained for each of the unstandardized regression coefficients to assess the probable value of the regression coefficients in the population.
6. Data from part and partial correlations were used to measure the unique relationship between an independent variable and the dependent variable known as the zero-order correlation or Pearson correlation (Field, 2009). Information on the partial correlation between each independent variable and the dependent variable, simultaneously controlling for all other independent variables in the model, is provided.
7. Information that was collected from the collinearity diagnostics include the variance inflation factor (*VIF*), tolerance, eigenvalues of the scaled, uncentered cross-product matrix, condition indexes, and variance proportions.
8. The Durbin-Watson was used to test for the assumption of independent errors. The rule of thumb used to satisfy the assumption of independent errors was how close to 2 the errors are situated. Error values less than 1 and greater than 3 were causes for concern (Field, 2009).
9. A casewise diagnostics was conducted also for the purpose of obtaining the observed value of the dependent variable, the predicted value of the dependent variable, the difference between these values or the residual, and the standardized difference. Field (2009) recommends listing all cases with a standardized residual above the criterion value of 2. Additionally, a summary table of residual statistics was generated displaying the minimum, maximum,

mean, and standard deviation of the observed and predicted values of the dependent variables predicted by the model and the residuals.

10. Regression plots were also generated to help to establish the validity of some regression assumptions. Graphs were generated for
    a. the outcome variable (dependent variable)
    b. the standardized predicted values of the dependent variable based on the model
    c. the standardized residuals (errors) the deleted residuals
    d. the adjusted predicted values
    e. the Studentized residual
    f. the Studentized deleted residual

    Plotting the standardized residuals (y-axis) against the standardized predicted values (x-axis) was useful in determining whether the assumptions of random errors and homoscedasticity had been met (Field, 2009). A plot of the studentized residual (y-axis) against the standardized predicted value (x-axis) displayed any heteroscedasticity (Field, 2009).
11. All cases that have missing data were excluded from the entire analysis.

Please refer to Table 10 for the summary of statistical tests used to address Research Questions 1 and 2.

Table 10

Summary of Statistical Test for Research Questions 1 and 2

Research Questions	Statistical Test	Assumptions	Statistics Information
1. What is the relationship between fourth-grade African American boys' attitudes toward teacher-student relationships and their mathematics achievement? 2. What is the relationship between fifth-grade African American boys' attitudes toward teacher-student relationships and their mathematics achievement?	Multiple Regression	All predictor variables must be quantitative or categorical and the outcome variable must be quantitative, continuous, and unbounded.	• Continuous variable • Interval variable

		The independent variables should have some variation in value, no zero variances.	• Descriptives: mean and standard deviation
			• Correlation matrix – Pearson's correlation coefficient *r*
			• one-tailed probability significance, *p*
			   o Condition indexes
			   o Variance proportions

(continued)

Research Questions	Statistical Test	Assumptions	Statistics Information
			• *Collinearity diagnostics*: o *VIF* o Tolerance o Eigenvalues of the scaled, uncentered cross-products matrix
		There should be no perfect linear relationship or multicollinearity between two or more of the independent variables.	• Correlation matrix – Pearson's correlation coefficient *r* • *Model fit*: o *R* o R^2 o adjusted R^2 o *R squared change* o *F*-ratio
		There should be no external variables included in the regression model that correlate with any of the variables included in the regression model.	*Part and partial correlations*
		At each level of the independent variables, the variance of the residual terms should be constant or have the same variance known as homoscedasticity. Heteroscedasticity are unequal variances should not be present.	• *Standardized residuals* (y-axis) vs. *standardized predicted values* (x-axis) • *Studentized residual* (y-axis) vs. *standardized predicted value* (x-axis)

(continued)

Research Questions	Statistical Test	Assumptions	Statistics Information
		Independent errors where any two observations are dependent of each other should not be present.	*Durbin-Watson*
		Normally distributed errors where the residuals in the model are random, normally distributed variables with a mean of zero or close to zero.	*Standardized residuals* (y-axis) *against the standardized predicted values* (x-axis)
		Independence of all the values of the dependent variable is expected.	*Estimates*: • *b* values • *t* test
		There is a linear relationship between the mean values of the dependent variable for each increment of the independent variables.	*Model fit*: • R • R^2 • adjusted R^2 • *R squared change* • *F*-ratio

CHAPTER IV

PRESENTATION AND ANALYSIS OF THE DATA

The purpose of the present 2-year longitudinal retrospective investigation was to determine whether there was a relationship between fourth- and fifth-grade African American boys' attitudes of teacher-student relationships and their mathematics achievement. Data from the Measuring Effective Teachers (MET) project conducted from 2009-2010 through 2010-2011 school years and sponsored by the Bill and Melinda Gates Foundation (2013a) were utilized in this study. Archived data from the MET project comprised students' individual responses from the Tripod survey and mathematics scores from state tests (Bill and Melinda Gates Foundation, 2013a).

In this chapter, I describe the data analyses and presentation of data for the research questions examined in this study. The following two research questions guided my study:

1. What is the relationship between fourth-grade African American boys' attitudes toward teacher-student relationships and their mathematics achievement?

2. What is the relationship between fifth-grade African American boys' attitudes toward teacher-student relationships and their mathematics achievement?

Description of Participants

Grades 4-5 African American boys enrolled in five districts across the U.S. who participated in the MET Project during the 2009-2010 and 2010-2011 school years were selected for the study. Besides being enrolled in participating districts, these students were enrolled in participating schools within the districts and in participating teachers' classrooms (also referred to as sections). Additionally, the African American boys had to have both mathematics scores from state tests and a completed Tripod survey for the year that they participated in the study. African American boys who did not have state mathematics scores, a completed Tripod survey, and not enrolled in a MET teacher's classroom were excluded during that year of the study. The number of participants for each of the studies by grade level is described in Table 11, and the mathematics scores from state test are listed in Table 12.

Table 11

Grades 4 and 5 Student Population over the 2- Year MET Study

Grade	2009 – 2010 School Year *N*	2010 – 2011 School Year *N*	Total
4th	1528	940	2468
5th	1607	1132	2739
Total	3135	2072	5207

Table 12

Mathematics State Test Results by Z-Score for 2009-2010 and 2010-2011 School Years

Grade	2009 -2010 School Year			2010 -2011 School Year		
	N	*M*	*SD*	*N*	*M*	*SD*
4th	1528	0.07	0.94	940	0.06	0.95
5th	1607	0.14	0.92	1132	0.07	0.93

Descriptive Statistics

R. Ferguson (2012, p. 2) designed the Tripod survey to measure seven areas of classroom concerns that he referred to as the "Tripod 7C's." The classroom areas of concern were care, control, clarity, challenge, captivate, confer, and consolidate, and each is used as a scale on the Tripod 7C's. Descriptive statistics pertaining to the Tripod 7C's and mathematics achievement were used to analyze the relationships and differences between the variables of this study. The independent variables examined were care, control, clarity, challenge, captivate, confer, and consolidate. The first scale is care that refers to the classroom. It is what teachers do to make students feel welcomed and emotionally safe to ask questions and not to be afraid of making mistakes. The second scale, control, concerns the management of the classroom in which teachers provide a learning atmosphere where students feel both physically and emotionally safe. The third scale, clarity, refers to what teachers do during instructional time to help students grasp the learning objectives being taught. The fourth scale, challenge, is where teachers hold students accountable for being able to demonstrate understanding of learned objectives, to reason through thought-provoking questions, and to analyze solutions. The fifth scale, captivate, refers to how teachers capture the attention of students and keep them engaged in the learning process. The sixth scale, confer, concerns students' involvement in the classroom setting. Teachers who confer with students involve them in decision-making processes and discussions stemming from learned objectives and general classroom procedures. The seventh scale, consolidate, measures how teachers check for understanding and help students organize material for more effective storing and retrieving of information. Teachers who help students consolidate incorporate the application of summarization skills throughout each lesson and provide feedback to students on the students' misconceptions of assigned task and on how to make improvements in their work (Kane & Staiger, 2010). They also guide students into making connections of the newly acquired knowledge with previous learned objectives within and across various content areas (Bill and Melinda Gates Foundation, 2013a; R. Ferguson, 2012).

Moreover, the Tripod survey represents a Likert-format scale, with each scale having differing numbers of survey items as follows: (a) care – 7; control – 4; clarity – 8; challenge – 4; captivate – 4; confer – 7; and consolidate – 2. Students responded to each item via a Likert-format scale of 5 = “yes, always”; 4 = “mostly yes”; 3 = “maybe/sometimes”; 2 = “mostly not”; 1 = “no, never.” The highest and lowest possible scores varied for each scale. Reverse items were included in the Tripod 7C’s to reduce response bias. An examination of the internal consistency of the Tripod 7C’s scale items was conducted to assess the reliability of each scale score. The Cronbach’s alpha for each of the scales was as follows: (a) care = 0.83; (b) control = 0.59; clarity = 0.78; challenge = 0.65; captivate = 0.70; confer = 0.77; and consolidate = 0.49. Generally, for a test to be deemed as yielding reliable scores, the accepted value of Cronbach’s alpha ranges from 0.70 to 0.80 (B. Thompson & Vacha-Haase, 2000; Vacha-Haase, Kogan, & Thompson, 2000; Witta & Daniel, 1998); however, according to Kline (1999/2013), psychological constructs below 0.70 can be expected due to the diversity of the constructs being measured, as was the case for the scales—control, challenge, and consolidate. In the current study, the Cronbach’s alpha for the current study ranged from .49 to .83 compared to .58 to .68 in the original MET study (Kane & Staiger, 2010). Table 13 shows the average reliability coefficients for the combined sample populations—Grades 4 and 5 African American boys. Table 14 and Table 15 show the minimum, maximum, mean scores, standard deviation, and Cronbach’s alpha of Grades 4 and 5 African American boys over the 2-year study.

Table 13

Average Cronbach's Alpha Reliability Coefficient for Each Tripod Scale from Combined Sample Population

Scale	Min.	Max.	Average
Care	0.79	0.85	0.83
Control	0.57	0.61	0.59
Clarity	0.78	0.72	0.83
Challenge	0.65	0.61	0.68
Captivate	0.68	0.72	0.70
Confer	0.74	0.80	0.77
Consolidate	0.43	0.54	0.49

Note. Average reliability coefficient of Grades Four and Five African American Boys over the 2-year longitudinal study.

Table 14

Grade Four Scores for Each Scale of the Tripod Survey for the 2009-2010 and 2010-2011 School Years

Scale	*N*	Min.	Max.	*M*	*SD*	Reliability: No. of items	Reliability: Cronbach's alpha
2009 -2010							
Care	1223	7	35	30.99	4.65	7	.81
Control	1251	4	20	14.80	2.75	4	.58
Clarity	1181	8	40	34.04	4.35	8	.73
Challenge	1171	4	20	15.84	3.18	4	.61
Captivate	1233	4	20	14.87	3.63	4	.71
Confer	1190	7	35	29.31	4.20	7	.74
Consolidate	1282	2	10	7.57	1.95	2	.48
2010 – 2011							
Care	729	7	35	29.62	4.42	7	.79
Control	772	4	20	14.33	2.68	4	.57
Clarity	707	8	40	33.92	3.93	8	.73
Challenge	753	4	20	16.49	2.98	4	.63
Captivate	750	4	20	15.00	3.30	4	.68
Confer	732	7	35	29.64	4.03	7	.75
Consolidate	784	2	10	7.90	1.76	2	.43

Note. *Some students did not respond to all survey items.*

Table 15

Grade Five Scores for Each Scale of the Tripod Survey for the 2009-2010 and 2010-2011 School Years

Scale	*N*	Min.	Max.	*M*	*SD*	Reliability: No. of items	Reliability: Cronbach's alpha
2009 – 2010							
Care	1230	7	35	28.78	5.23	7	.85
Control	1299	4	20	14.68	2.72	4	.60
Clarity	1246	8	40	33.87	4.80	8	.82
Challenge	1206	4	20	15.94	3.09	4	.68
Captivate	1283	4	20	13.85	3.66	4	.72
Confer	1255	7	35	28.94	4.52	7	.80
Consolidate	1307	2	10	7.24	2.03	2	.54
2010 – 2011							
Care	928	7	35	28.58	5.55	7	.85
Control	974	4	20	14.23	2.94	4	.61
Clarity	921	8	40	33.79	5.00	8	.83
Challenge	936	4	20	16.74	2.86	4	.66
Captivate	973	4	20	14.35	3.40	4	.70
Confer	948	7	35	29.74	4.36	7	.80
Consolidate	979	2	10	7.58	1.91	2	.52

Note. Some students did not respond to all survey items.

Care scale. The first scale is care. It pertains to the classroom environment on what teachers do to make students feel welcomed and emotionally safe to ask questions and not to be afraid of making mistakes (Bill and Melinda Gates Foundation, 2013a; R. Ferguson, 2012). This section of the Tripod survey has seven items. Students scored each statement using a Likert-format scale of 5 = “yes, always”; 4 = “mostly yes”; 3 = “maybe/sometimes”; 2 = “mostly not”; and 1 = “no, never.” Table 16 and Table 17 show the minimum, maximum, mean scores, and standard deviations of the students’ responded to each care statement.

Table 16

Grade 4 Care for 2009-2010 and 2010-2011 School Years

Care Statements	*N*	Min.	Max.	*M*	*SD*
			2009 -2010		
My teacher in this class makes me feel that he/she really cares about me.	1336	1	5	4.40	0.93
The teacher in this class encourages me to do my best.	1328	1	5	4.56	0.79
My teacher gives us time to explain our ideas.	1333	1	5	4.20	0.95
My teacher seems to know if something is bothering me.	1303	1	5	3.81	1.19
If I am sad or angry, my teacher helps me feel better.	1300	1	5	4.00	1.23
My teacher is nice to me when I ask questions.	1344	1	5	4.51	0.80
I like the way my teacher treats me when I need help.	1341	1	5	4.52	0.81
			2010 -2011		
My teacher in this class makes me feel that he/she really cares about me.	813	1	5	4.30	0.97
The teacher in this class encourages me to do my best.	819	1	5	4.63	0.73
My teacher gives us time to explain our ideas.	808	1	5	4.11	0.93
My teacher seems to know if something is bothering me.	804	1	5	3.67	1.18
If I am sad or angry, my teacher helps me feel better.	805	1	5	3.92	1.21
My teacher is nice to me when I ask questions.	835	1	5	4.46	0.80
I like the way my teacher treats me when I need help.	700	1	5	4.58	0.73

Note. *Some students did not respond to all survey items.*

Table 17

Grade 5 Care for 2009-2010 and 2010-2011 School Years

Care Statements	*N*	Min.	Max.	*M*	*SD*
			2009 -2010		
My teacher in this class makes me feel that he/she really cares about me.	1363	1	5	4.22	1.01
The teacher in this class encourages me to do my best.	1350	1	5	4.47	0.87
My teacher gives us time to explain our ideas.	1349	1	5	4.03	0.98
My teacher seems to know if something is bothering me.	1331	1	5	3.52	1.21
If I am sad or angry, my teacher helps me feel better.	1314	1	5	3.63	1.34
My teacher is nice to me when I ask questions.	1367	1	5	4.45	0.85
I like the way my teacher treats me when I need help.	1367	1	5	4.43	0.88
			2010 -2011		
My teacher in this class makes me feel that he/she really cares about me.	996	1	5	4.07	1.14
The teacher in this class encourages me to do my best.	1000	1	5	4.55	0.85
My teacher gives us time to explain our ideas.	1004	1	5	4.05	0.96
My teacher seems to know if something is bothering me.	1002	1	5	3.55	1.25
If I am sad or angry, my teacher helps me feel better.	977	1	5	3.66	1.33
My teacher is nice to me when I ask questions.	1012	1	5	4.40	0.80
I like the way my teacher treats me when I need help.	997	1	5	4.33	0.97

Note. *Some students did not respond to all survey items.*

Control scale. The second scale is control. It concerns the management of the classroom where teachers are responsible for providing physically and emotionally safe learning atmosphere for student (Bill and Melinda Gates Foundation, 2013a; R. Ferguson, 2012). This section of the Tripod survey has four items. Students scored each statement using a Likert-format scale of 5 = “yes, always”; 4 = “mostly yes”; 3 = “maybe/sometimes”; 2 = “mostly not”; and 1 = “no, never.” One reverse item was included in the control scale to reduce response bias. Table 18 and Table 19 show the minimum, maximum, mean scores, and standard deviations of students’ responses to each care statement.

Table 18

Grade 4 Control for 2009 -2010 and 2010-2011 School Years

Control Statements	*N*	Min.	Max.	*M*	*SD*
2009-2010					
Our class stays busy and does not waste time.	1324	1	5	3.74	0.95
Students behave so badly in this class that it slows down our learning (reverse coded).	1331	1	5	3.38	1.24
Everybody knows what they should be doing and learning in this class.	1331	1	5	4.20	0.85
My classmates behave the way my teacher wants them to.	1308	1	5	3.46	1.06
2010-2011					
Our class stays busy and does not waste time.	817	1	5	3.67	0.98
Students behave so badly in this class that it slows down our learning (reverse coded).	812	1	5	3.25	1.20
Everybody knows what they should be doing and learning in this class.	819	1	5	4.13	0.89
My classmates behave the way my teacher wants them to.	809	1	5	3.26	1.01

Note. Some students did not respond to all survey items.

Table 19

Grade 5 Control for 2009-2010 and 2010-2011 School Years

Control Statements	*N*	Min.	Max.	*M*	*SD*
2009-2010					
Our class stays busy and does not waste time.	1366	1	5	3.81	0.93
Students behave so badly in this class that it slows down our learning (reverse coded).	1357	1	5	3.41	1.18
Everybody knows what they should be doing and learning in this class.	1368	1	5	4.10	.81
My classmates behave the way my teacher wants them to.	1346	1	5	3.35	1.05
2010-2011					
Our class stays busy and does not waste time.	1003	1	5	3.72	0.98
Students behave so badly in this class that it slows down our learning (reverse coded).	1000	1	5	3.28	1.18
Everybody knows what they should be doing and learning in this class.	1003	1	5	4.05	0.91
My classmates behave the way my teacher wants them to.	1005	1	5	3.15	1.05

Note. Some students did not respond to all survey items.

Clarity scale. The third scale is Clarify. This refers to what teachers do during instructional time to help students grasp learning objectives being taught (Bill and Melinda Gates Foundation, 2013a; R. Ferguson, 2012). Teachers must be able to understand and to address the various needs of individual students (e.g., backgrounds, learning modalities, interests). This section of the Tripod survey has eight items. Students scored each statement using a Likert-format scale of 5 = “yes, always”; 4 = “mostly yes”; 3 = “maybe/sometimes”; 2 = “mostly not”; and 1 = “no, never.” Table 20 And Table 21 show the minimum, maximum, mean scores, and standard deviations of students’ responses to each care statement.

Table 20

Grade 4 Clarity for 2009 -2010 and 2010 -2011 School Years

Clarity Statements	*N*	Min.	Max.	*M*	*SD*
		2009 – 2010			
My teacher explains things in very orderly ways.	1302	1	5	4.09	1.04
In this class, we learn to correct our mistakes.	1327	1	5	4.51	0.79
My teacher knows when the class understands, and when we do not.	1324	1	5	4.16	0.94
I understand what I am supposed to be learning in this class.	1322	1	5	4.34	0.83
If you don't understand something, my teacher explains it another way.	1345	1	5	4.32	0.88
My teacher has several good ways to explain each topic that we cover in this class.	1318	1	5	4.24	0.89
My teacher is nice to me when I ask questions.	1332	1	5	4.35	0.91
This class is neat -- everything has a place and things are easy to find.	1306	1	5	4.03	1.05
		2010-2011			
My teacher explains things in very orderly ways.	801	1	5	4.19	0.091
In this class, we learn to correct our mistakes.	794	1	5	4.56	0.72
My teacher knows when the class understands, and when we do not.	806	1	5	4.20	0.88

(continued)

Clarity Statements	*N*	Min.	Max.	*M*	*SD*
I understand what I am supposed to be learning in this class.	804	1	5	4.32	0.79
If you don't understand something, my teacher explains it another way.	830	1	5	4.26	0.90
My teacher has several good ways to explain each topic that we cover in this class.	820	1	5	4.25	0.87
My teacher explains difficult things clearly.	825	1	5	4.25	0.96
This class is neat -- everything has a place and things are easy to find.	804	1	5	3.93	1.03

Note. Some students did not respond to all survey items

Table 21

Grade 5 Clarity for 2009-2010 and 2010-2011 School Years

Clarity Statements	*N*	Min.	Max	*M*	*SD*
2009 – 2010					
My teacher explains things in very orderly ways.	1341	1	5	4.02	1.03
In this class, we learn to correct our mistakes.	1365	1	5	4.47	0.77
My teacher knows when the class understands, and when we do not.	1357	1	5	4.14	0.95
I understand what I am supposed to be learning in this class.	1350	1	5	4.27	0.82
If you don't understand something, my teacher explains it another way.	1373	1	5	4.36	0.87
My teacher has several good ways to explain each topic that we cover in this class.	1358	1	5	4.26	0.88
My teacher explains difficult things clearly.	1367	1	5	4.30	0.90
This class is neat -- everything has a place and things are easy to find.	1339	1	5	4.04	1.00
2010-2011					
My teacher explains things in very orderly ways.	998	1	5	4.10	0.95
In this class, we learn to correct our mistakes.	997	1	5	4.44	0.83
My teacher knows when the class understands, and when we do not.	996	1	5	4.17	0.95

(continued)

Clarity Statements	*N*	Min.	Max	*M*	*SD*
I understand what I am supposed to be learning in this class.	998	1	5	4.30	0.83
If you don't understand something, my teacher explains it another way.	1013	1	5	4.29	0.92
My teacher has several good ways to explain each topic that we cover in this class.	1002	1	5	4.21	0.92
My teacher explains difficult things clearly.	1000	1	5	4.29	0.89
This class is neat -- everything has a place and things are easy to find.	991	1	5	3.96	1.04

Note. Some students did not respond to all survey items.

Challenge scale. The fourth scale is Challenge. It concerns "effort and rigor—pressing students to work hard and to think hard," as explained by R. Ferguson (2012, p. 26). Teachers who challenge students promote and build endurance in students when learning difficulties arise. This section of the Tripod survey has four items. Students scored each statement using a Likert-format scale of 5 = "yes, always"; 4 = "mostly yes"; 3 = "maybe/sometimes"; 2 = "mostly not"; and 1 = "no, never." Table 22 and Table 23 show the minimum, maximum, mean scores, and standard deviations of students' responses to each care statement.

Table 22

Grade 4 Challenge for 2009-2010 and 2010-2011 School Years

Challenge Statements	*N*	Min.	Max.	*M*	*SD*
2009-2010					
My teacher pushes us to think hard about things we read.	1282	1	5	3.69	1.29
In this class, my teacher accepts nothing less than our full effort.	1289	1	5	4.29	0.96
In this class we have to think hard about the writing we do.	1251	1	5	3.93	1.14
My teacher pushes everybody to work hard.	1335	1	5	3.96	1.23
2010-2011					
My teacher pushes us to think hard about things we read.	821	1	5	3.84	1.25
In this class, my teacher accepts nothing less than our full effort.	808	1	5	4.39	0.88
In this class we have to think hard about the writing we do.	798	1	5	4.17	0.95
My teacher pushes everybody to work hard.	820	1	5	4.09	1.20

Note. Some students did not respond to all survey items.

Table 23

Grade 5 Challenge for 2009-2010 and 2010-2011 School Years

Challenge Statements	*N*	Min.	Max.	*M*	*SD*
2009 -2010					
My teacher pushes us to think hard about things we read.	1288	1	5	3.75	1.20
In this class, my teacher accepts nothing less than our full effort.	1351	1	5	4.27	0.91
In this class we have to think hard about the writing we do.	1275	1	5	3.71	1.14
My teacher pushes everybody to work hard.	1356	1	5	4.19	1.06
2010-2011					
My teacher pushes us to think hard about things we read.	987	1	5	3.98	1.14
In this class, my teacher accepts nothing less than our full effort.	999	1	5	4.44	0.83
In this class we have to think hard about the writing we do.	971	1	5	3.98	1.06
My teacher pushes everybody to work hard.	1005	1	5	4.37	1.00

Note. Some students did not respond to all survey items.

Captivate scale. The fifth scale is captivate. It refers to how teachers capture the attention of the students and keeps them engaged in the learning process (Bill and Melinda Gates Foundation, 2013a; R. Ferguson, 2012). This section of the Tripod survey has four items. Students scored each statement using a Likert-format scale of 5 = “yes, always”; 4 = “mostly yes”; 3 = “maybe/sometimes”; 2 = “mostly not”; and 1 = “no, never.” One reverse item was included in the captivate scale to reduce response bias.

Table 24 and Table 25 show the minimum, maximum, mean scores, and standard deviations of students' responses to each care statement.

Table 24

Grade 4 Captivate for 2009-2010 and 2010-2011 School Years

Captivate Statements	*N*	Min.	Max.	*M*	*SD*
2009-2010					
We have interesting homework.	1328	1	5	3.53	1.25
Homework helps me learn.	1332	1	5	4.19	1.07
School work is interesting.	1306	1	5	3.71	1.21
School work is not very enjoyable (reverse coded).	1307	1	5	3.40	1.44
2010-2011					
We have interesting homework.	814	1	5	3.54	1.16
Homework helps me learn.	826	1	5	4.22	1.03
School work is interesting.	813	1	5	3.80	1.04
School work is not very enjoyable (reverse coded).	795	1	5	3.43	1.35

Note. Some students did not respond to all survey items.

Table 25

Grade 5 Captivate for 2009-2010 and 2010-2011 School Years

Captivate Statements	*N*	Min.	Max.	*M*	*SD*
2009-2010					
We have interesting homework.	1353	1	5	3.26	1.21
Homework helps me learn.	1360	1	5	3.88	1.18
School work is interesting.	1348	1	5	3.43	1.19
School work is not very enjoyable (reverse coded).	1348	1	5	3.27	1.37
2010-2011					
We have interesting homework.	1004	1	5	3.32	1.19
Homework helps me learn.	1010	1	5	4.02	1.09
School work is interesting.	1004	1	5	3.63	1.11
School work is not very enjoyable (reverse coded).	997	1	5	3.35	1.30

Note. Some students did not respond to all survey items.

Confer scale. The sixth scale is confer. It concerns students' involvement in the classroom setting (Bill and Melinda Gates Foundation, 2013a; R. Ferguson, 2012). Teachers who confer with students involve them in decision-making processes and discussions stemming from learned objectives and general classroom procedures. This section of the Tripod survey had seven items. Students scored each statement using a Likert-format scale of 5 = "yes, always"; 4 = "mostly yes"; 3 = "maybe/sometimes"; 2 = "mostly not"; and 1 = "no, never." Table 26 and Table 27 show the minimum, maximum, mean scores, and standard deviations of how students responded to each care statement.

Table 26

Grade 4 Confer for 2009-2010 and 2010-2011 School Years

Confer Statements	*N*	Min.	Max.	*M*	*SD*
			2009-2010		
My teacher wants me to explain my answers -- why I think what I think.	1307	1	5	4.22	0.94
When he/she is teaching us, my teacher asks us whether we understand.	1328	1	5	4.35	0.88
My teacher tells us what we are learning and why.	1327	1	5	4.26	0.92
My teacher asks questions to be sure we are following along when he/she is teaching.	1324	1	5	4.38	.88
My teacher checks to make sure we understand what he/she is teaching us.	1320	1	5	4.43	0.83
My teacher wants us to share our thoughts.	1319	1	5	3.91	1.13
Students speak up and share their ideas about class work.	1308	1	5	3.73	1.14
			2010-2011		
My teacher wants me to explain my answers -- why I think what I think.	786	1	5	4.22	0.90
When he/she is teaching us, my teacher asks us whether we understand.	819	1	5	4.35	.858
My teacher tells us what we are learning and why.	811	1	5	4.30	0.90
My teacher asks questions to be sure we are following along when he/she is teaching.	816	1	5	4.40	0.86

(continued)

Confer Statements	*N*	Min.	Max.	*M*	*SD*
My teacher checks to make sure we understand what he/she is teaching us.	807	1	5	4.52	0.74
My teacher wants us to share our thoughts.	813	1	5	4.05	1.06
Students speak up and share their ideas about class work.	817	1	5	3.78	1.05

Note. Some students did not respond to all survey items.

Table 27

Grade 5 Confer for 2009-2010 and 2010-2011 School Years

Confer Statements	*N*	Min.	Max.	*M*	*SD*
			2009-2010		
My teacher wants me to explain my answers -- why I think what I think.	1353	1	5	4.15	0.97
When he/she is teaching us, my teacher asks us whether we understand.	1365	1	5	4.43	0.85
My teacher tells us what we are learning and why.	1355	1	5	4.14	1.00
My teacher asks questions to be sure we are following along when he/she is teaching.	1358	1	5	4.40	0.82
My teacher checks to make sure we understand what he/she is teaching us.	1351	1	5	4.40	0.85
My teacher wants us to share our thoughts.	1350	1	5	3.81	1.09
Students speak up and share their ideas about class work.	1351	1	5	3.60	1.15
			2010-2011		
My teacher wants me to explain my answers -- why I think what I think.	981	1	5	4.23	0.93
When he/she is teaching us, my teacher asks us whether we understand.	1007	1	5	4.50	0.85
My teacher tells us what we are learning and why.	1001	1	5	4.28	.096
My teacher asks questions to be sure we are following along when he/she is teaching.	1004	1	5	4.47	0.84

(continued)

Confer Statements	*N*	Min.	Max.	*M*	*SD*
My teacher checks to make sure we understand what he/she is teaching us.	1006	1	5	4.50	0.775
My teacher wants us to share our thoughts.	1004	1	5	3.99	1.05
Students speak up and share their ideas about class work.	1009	1	5	3.71	1.06

Note. Some students did not respond to all survey items.

Consolidate scale. The seventh scale is consolidate. It relates to how teachers check for understanding and help students organize material for more effective storing and retrieving of information (Bill and Melinda Gates Foundation, 2013a; R. Ferguson, 2012). Teachers who help students consolidate incorporate the application of summarization skills throughout each lesson. This section of the Tripod survey has two items. Students scored each statement using a Likert-format scale of 5 = "yes, always"; 4 = "mostly yes"; 3 = "maybe/sometimes"; 2 = "mostly not"; and 1 = "no, never." Table 28 and Table 29 show the minimum, maximum, mean scores, and standard deviations of students' responses to each care statement.

Table 28

Grade 4 Consolidate for 2009-2010 and 2010-2011 School Years

Consolidate Statements	*N*	Min.	Max.	*M*	*SD*
		2009-2010			
When my teacher marks my work, he/she writes on my papers to help me understand how to do better.	1315	1	5	3.85	1.21
My teacher takes the time to summarize what we learn each day.	1309	1	5	3.71	1.20
		2010 -2011			
When my teacher marks my work, he/she writes on my papers to help me understand how to do better.	802	1	5	3.92	1.12
My teacher takes the time to summarize what we learn each day.	800	1	5	3.98	1.06

Note. Some students did not respond to all survey items.

Table 29

Grade 5 Consolidate for 2009 – 2010 and 2010 – 2011 School Years

Consolidate Statements	*N*	Min.	Max.	*M*	*SD*
2009 -2010					
When my teacher marks my work, he/she writes on my papers to help me understand how to do better.	1337	1	5	3.71	1.22
My teacher takes the time to summarize what we learn each day.	1338	1	5	3.52	1.23
2010-2011					
When my teacher marks my work, he/she writes on my papers to help me understand how to do better.	998	1	5	3.74	1.12
My teacher takes the time to summarize what we learn each day.	987	1	5	3.85	1.12

Note. Some students did not respond to all survey items.

Research Question 1: What is the relationship between fourth-grade African American boys' attitudes toward teacher-student relationships and their mathematics achievement?

The means and standard deviations for one continuous dependent variable-mathematics scores and the seven continuous independent variable—care, control, clarity, challenge, captivate, confer, and consolidate—are presented in Table 30. The data for mathematics scores and each scale on the Tripod 7'Cs—care, control, clarity, challenge, captivate, confer, and consolidate—were obtained independently, thereby meeting the assumption of independence. Additionally, an analysis of the scatterplots (not presented) involving mathematics scores and the seven independent variables indicated no evidence of curvilinear relationships. From observations of the scatterplots, the mathematics scores increased as care, control, clarity, challenge, and confer increased. The relationship between mathematics scores and five of the scales—care, control, clarity, challenge, and confer—indicated a positive linear relationship. However, mathematics scores declined as captivate and consolidate increased in Year 1 and Year 2 of the study. Thus, the relationship between mathematics scores and two of the scales, captivate and consolidate, indicated an inverse linear relationship. Therefore, the assumption of linearity was met for both years of the study. Correlational analyses of this study were warranted because the assumptions of independence and linearity were evidenced.

Table 30

Mean and Standard Deviation for Grade 4 Students' Mathematics Scores and Tripod 7C's Scales for 2009-2010 and 2010-2011 School Years

Variable	2009-2010			2010-2011		
	N	*M*	*SD*	*N*	*M*	*SD*
Mathematics	878	0.12	0.89	578	0.16	0.92
Care	878	30.02	4.67	578	29.69	4.41
Control	878	14.76	2.78	578	14.34	2.67
Clarity	878	34.09	4.34	578	33.92	3.95
Challenge	878	15.89	3.14	578	16.50	2.90
Captivate	878	15.04	3.61	578	14.91	3.27
Confer	878	29.46	4.21	578	29.68	4.04
Consolidate	878	7.64	1.95	578	7.89	1.72

An examination of the histograms (not shown) revealed a negative skewed distribution of the data yielded by the Tripod 7C's scales. Scrutinizing the distribution of scores underlying the independent and dependent variables, the skewness and kurtosis coefficients were observed. The skewness and kurtosis coefficients were outside the bounds of normality for most of the scales and mathematics scores. In particular, the standardized skewness (i.e., skewness divided by the standard error of skewness) and standardized kurtosis (i.e., kurtosis divided by the standard error of kurtosis) were not between -3.00 and 3.00. According to Fields (2009),

> Large samples will give rise to small standard errors and so when sample sizes are big, significant values arise from even small deviations from normality…It is more important to look at the shape of the distribution visually and to look at the

value of the skewness and kurtosis statistics rather than calculate their significance. (p. 139)

Taking into account the population of this study was 1,528 Grade 4 African American boys during Year 1 and 940 Grade 4 African American boys in Year 2, the skewness and kurtosis coefficients were within the normal range for normality (Field, 2009), which justified conducting a multiple linear regression analysis (Field, 2009); nevertheless, caution should be exercised in interpreting the results. Presented in Table 31 are the skewness coefficients and kurtosis coefficients pertaining to each scale of the Tripod 7C's for Grade 4 African American boys over the 2-year period of the study.

Table 31

Skewness Coefficients and Kurtosis Coefficients for the Tripod 7C's Scales for Grade 4 Students during the 2009-2010 and 2010-2011 School Years

Scale	2009-2010			2010-2011		
	N	Skewness Coefficient	Kurtosis Coefficient	*N*	Skewness Coefficient	Kurtosis Coefficient
Care	1223	-1.31	1.67	729	-1.05	0.96
Control	1251	-0.29	-0.14	772	-0.27	0.12
Clarity	1181	-0.96	1.27	707	-0.62	0.11
Challenge	1171	-0.62	-0.15	753	-0.83	0.19
Captivate	1233	-0.58	0.02	750	-0.68	0.09
Confer	1190	-0.90	1.13	732	-0.96	1.64
Consolidate	1282	-0.63	-0.15	784	-0.72	0.14

Prior to performing the multiple linear regression analysis, a series of Pearson's product moment correlation coefficients (i.e., Pearson's r) was calculated to determine the relationship between mathematics scores and the seven independent variables—care, control, clarity, challenge, captivate, confer, and consolidate. The Bonferroni correction was applied to control the error rate of the seven computed correlation coefficients involving the independent variables so that the total experimentwise error rate did not exceed 5% (e.g., Chandler, 1995; Ho, 2006; Manly, 2004; Vogt, 2005). This correction was determined by dividing the nominal alpha value by 7 (i.e., .05/7 = .007). Therefore, the adjusted level of statistical significance was .007. Including the Bonferroni adjustment, the series of Pearson's *r* revealed that for the 2009-2010 school year, there were two statistically significant relationships. Specifically, mathematics scores were statistically significantly related to control (r [1240] = .11, $p < .000$) and consolidate (r [1270] = -.14, $p < .000$). For the 2010-2011 school year, there was only one statistically significant relationship. Specifically, mathematics scores remained statistically significantly related to consolidate (r [779] = -.11, $p < .002$). Based on Cohen's (1988) effect size criteria, the relationships involving control and consolidate were very small. However, of the two relationships, the association between mathematics scores and consolidate was the largest.

An *all possible subsets* (APS) multiple linear regression (Onwuegbuzie & Daniel, 2003; B. Thompson 1995) was utilized. By incorporating the APS technique, which is advocated by a number of statisticians (e.g., Onwuegbuzie & Daniel, 2003; B. Thompson 1995), all possible models comprising some or all of the independent variables were inspected to ascertain the best subset of independent variables conferring to Cohen's (1988) criterion of the maximum proportion of variance explained (R^2), which represents the effect size. The R^2 values for the multiple linear regression models for the 2009-2010 and 2010-2011 school years have been displayed in Table 32. The multiple linear regression model with the largest R^2 value was the seven-variable model encompassing all the independent variables (R^2 = .064) for Year 1 of this study. Similarly, the multiple linear regression model with the largest R^2 value was the seven-variable model encompassing all the independent variables (R^2 = .046) for Year 2 of this study. The model fit then was examined.

Table 32

R^2 Values for the Multiple Linear Regression Models Encompassing Year 1 and Year 2 of the Study with Grade 4 African American Boys

Multiple Linear Regression Model	Year 1 - R^2	Year 2 - R^2
Seven-Variable Model: Care Control Clarity Challenge Captivate Confer Consolidate	.064	.046

For the seven-variable model for Year 1 and Year 2 of this study, the following information is presented in Table 33 and Table 34: the unstandardized regression coefficients and intercept, the standard error of the unstandardized coefficients, the standardized regression coefficients, the structure coefficients, the semi-partial correlations, the partial correlation coefficients, the squared multiple correlation coefficients (R^2) of the chosen model, the tolerance statistics, the variance inflation factors, and the condition numbers. This particular model indicated that care, control, clarity, challenge, captivate, confer, and consolidate contributed statistically significantly (F [7, 870] = 8.552, p < .0001 to the prediction of overall mathematics scores for Year 1.

In Year 2, the seven-variables model indicated that care, control, clarity, challenge, captivate, confer, and consolidate contributed statistically significantly (F [7, 570] = 3.967, $p < .0001$) to the prediction of overall mathematics scores. However, these seven variables combined to explain 6.4% of the variation in mathematics scores for Year 1 and 4.6% for Year 2. According to Cohen (1988), for regression models in the social and behavioral sciences, R^2 values between 2% and 12.99% suggest small effect sizes, values between 13% and 25.99% indicate moderate effect sizes, and values of 26% and greater suggest large effect sizes. The R^2 values of 6.4% and 4.6% for Year 1 and Year 2 of this study, respectively, represented a small effect size, which is consistent with the correlation coefficient. Thus, the selected final model represented a very small effect size for both years.

Table 33

Selected Multiple Regression Model for Predicting Grade 4 African American Boys' Mathematics Scores in Year 1

Variable	Regression Coefficient	Standard Error	*t* Value	Standard Regression Coefficient	Structure Coefficient	Squared Part	Squared Partial	Tolerance	VIF	Condition Index
Intercept	-0.76	.26	-2.96							1.00
Care	0.02	.01	1.79	.09	.07	.06	.06	.43	2.31	14.07
Control	0.05	.01	4.23	.16	.14	.14	.14	.79	1.26	14.36
Clarity	0.02	.01	1.44	.08	.06	.05	.05	.37	2.71	16.32
Challenge	0.02	.01	1.64	.06	.04	.05	.06	.82	1.22	20.67
Captivate	-0.03	.01	-2.69	-.11	-.05	-.09	-.09	.70	1.42	27.23
Confer	-0.00	.01	-0.13	-.01	.02	-.00	.01	.44	2.30	32.45
Consolidate	-0.10	.02	-5.22	-.21	-.12	-.17	-.17	.64	1.56	41.04

Note.
VIF = Variance Inflation Factor
Part = Semi-Partial Correlation Coefficient
Partial = Partial Correlation Coefficient

Model R^2 = .064, F [7, 870] = 8.55, $p < .0001$

Adjusted R^2 = .057

$^*p < .05$, $^{**}p < .01$, $^{***}p < .0001$

Table 34

Selected Multiple Regression Model for Predicting Grade 4 African American Boys' Mathematics Scores in Year 2

Variable	Regression Coefficient	Standard Error	*t* Value	Standard Regression Coefficient	Structure Coefficient	Squared Part	Squared Partial	Tolerance	VIF	Condition Index
Intercept	-0.38	.36	-1.05							1.00
Care	0.02	.01	1.62	.105	.05	.07	.07	.40	2.50	15.29
Control	0.01	.02	0.88	.041	.05	.04	.04	.77	1.31	16.43
Clarity	0.04	.02	2.56	.166	.07	.11	.11	.40	2.52	17.59
Challenge	0.01	.01	0.40	.018	.02	.02	.02	.81	1.23	22.32
Captivate	-0.03	.01	-2.00	-.091	-.05	-.08	-.08	.77	1.30	27.66
Confer	-0.02	.01	-1.27	-.078	-.02	-.05	-.05	.44	2.26	36.12
Consolidate	-0.10	.03	-3.78	-.193	-.11	-.16	-.16	.64	1.56	42.83

Note.
VIF = Variance Inflation Factor
Part = Semi-Partial Correlation Coefficient
Partial = Partial Correlation Coefficient

Model $R^2 = .046$, $F\ [7, 570] = 3.97$, $p < .0001$

Adjusted $R^2 = .035$
*$p < .05$, **$p < .01$, ***$p < .0001$

In consideration of the assumptions for the selected seven-variable multiple linear regression model, the Durbin-Watson coefficient of 1.77 for Year 1 and 1.87 for Year 2 was sufficiently close to 2, that suggested for any two observations, the residual terms were uncorrelated (i.e., lack of autocorrelation). Furthermore, the absence of autocorrelation in the seven-variable multiple linear regression model was a desirable outcome. Both the histogram of the standardized residuals and the normal probability plot (not presented) suggested that the residuals in the model were normally distributed and linear based on the bell-shaped curve and straight line observed, respectively. This observed data satisfied the assumption of normality and linearity, which are associated with multiple linear regression. Further, the scatterplot of both the standardized residual against the standardized predicted value (not presented) and studentized residual against the standardized predicted value (not presented) suggested that the assumption of random errors and homoscedasticity were met. In addition, an examination of the standardized residuals pertaining to each of the participants in Year 1 revealed that 20 participants had standardized residuals that exceeded the absolute value of 2.00, which represented 2.28% (i.e., 20/878) of the total sample. In Year 2, 19 participants had standardized residuals that exceeded the absolute value of 2.00, which represented 3.29% (i.e., 19/578. Nevertheless, the number of participants with large standardized residual in both years of the study was less than the 5% expected by chance, which suggested little cause for concern.

An inspection of the tolerance statistics, the variance inflation factors, and the condition indices of the selected regression model for both years (cf. Table 33 and Table 34) indicated that no multicollinearity was present. In particularly, the variance inflation factors, which denote the extent that the variance of an individual regression coefficient has been inflated by the presence of collinearity, were much lower than 10, emphasizing little evidence of multicollinearity (Myers, 1986). Actually, the variance inflation factors were relatively close to 2.00, which indicated no relationship existed among the seven independent variables. Condition indices, which represent the ratio of the largest to the smallest eigenvalues, also provided information about the strength of linear dependency among the independent variables. From Table 33 and Table 34, the condition indices were much less than 1,000 (Myers, 1986), reiterating the fact that multicollinearity was not present. In addition, the tolerance statistics were greater than 0.2 (Field, 2009), which also indicated a lack of multicollinearity.

From the partial and semi-partial correlation coefficients (Table 33 and Table 34), it can be seen that consolidate was the best predictor of mathematics scores for both years of the study. An examination of the structure coefficients (Table 33 and Table 34), using a cutoff correlation of 0.3 recommended by Lambert and Durand (1975) as an acceptable minimum coefficient, suggested that the independent variables did not make important contributions to the model. However, statistical significance does not always correspond to practical significance, and it is important to note that most of the correlation coefficients generated in the social and behavioral sciences, including educational research like my study, are relatively small, between .20 and .40 (Sirkin, 2006). In summary, the selected final regression model indicated that as teachers help students to consolidate mathematics objectives, students tend to have lower mathematics scores. The regression equation for Year 1 was as follows:

mathematics scores = -0.76 - 0.14*consolidate + 0.07*care + 0.11*control + 0.05*clarity + .03*challenge -.07*captivate -.01* confer. This equation indicated that every 1-point increase in consolidate was associated with a 0.14 decline in mathematics scores. The regression equation for Year 2 was as follows: mathematics scores = -0.38 - 0.11*consolidate + 0.03*care + 0.01*control + 0.05*clarity + .01*challenge - .06*captivate -.01* confer. This equation indicated that every 1-point increase in consolidate was associated with a 0.11 decline in mathematics scores. Consequently, every 10-point increase in consolidate was associated with approximately a 1.4 decrease in mathematics scores in Year 1 and a 1.1 decrease in mathematics scores in Year 2.

Research Question 2: What is the relationship between fifth-grade African American boys' attitudes toward teacher-student relationships and their mathematics achievement?

The means and standard deviations for the dependent variable, mathematics scores, and the seven independent variables—care, control, clarity, challenge, captivate, confer, and consolidate—are presented in Table 35. The data for mathematics scores and each scale on the Tripod 7'Cs—care, control, clarity, challenge, captivate, confer, and consolidate—were obtained independently, thereby meeting the assumption of independence. Additionally, an analysis of the scatterplots (not presented) involving mathematics scores and the seven independent variables indicated no evidence of curvilinear relationships. From observations of the scatterplots, the mathematics scores increased as care, control, clarity, challenge, and confer increased. The relationship between mathematics scores and five of the scales-care, control, clarity, challenge, and confer, indicated a positive linear relationship. However, mathematics scores declined as captivate and consolidate increased in Year 1 and Year 2 of the study. Thus, the relationship between mathematics scores and two of the scales, captivate and consolidate, indicated an inverse linear relationship. Therefore, the assumption of linearity was met for both years of the study. Correlational analyses of this study were warranted because the assumptions of independence and linearity were evidenced.

Table 35

Mean and Standard Deviation for Grade Five Students' Mathematics Scores and Tripod 7C's Scales for 2009 – 2010 and 2010 – 2011 School Years

Variable	2009-2010			2010-2011		
	N	*M*	*SD*	*N*	*M*	*SD*
Mathematics	927	0.18	0.92	752	0.13	0.90
Care	927	28.76	5.30	752	28.52	5.66
Control	927	14.65	2.74	752	14.13	3.00
Clarity	927	33.90	4.85	752	33.70	5.14
Challenge	927	16.01	3.08	752	16.78	2.89
Captivate	927	13.95	3.62	752	14.34	3.45
Confer	927	28.95	4.71	752	29.67	4.49
Consolidate	927	7.24	2.07	752	7.61	1.94

An examination of the histograms (not shown) revealed a negative skewed distribution of the data yielded by the Tripod 7C's scales. Scrutinizing the distribution of scores underlying the continuous and independent variables, the skewness and kurtosis coefficients were observed. The skewness and kurtosis coefficients were outside the bounds of normality for most of the scales and mathematics scores. In particular, the standardized skewness and standardized kurtosis were not between -3.00 and 3.00.

Taking into account that the population of this study was 1,607 Grade 5 African American boys during Year 1 and 1,132 Grade 5 African American boys in Year 2, the skewness and kurtosis coefficients were within the normal range for normality (Field, 2009), which justified conducting a multiple linear regression analysis (Field, 2009); nevertheless, caution should be exercised in interpreting the results. Presented in Table 36 are the skewness coefficients and kurtosis coefficients pertaining to each scale of the Tripod 7C's for Grade 5 African American boys over the 2-year period of the study.

Table 36

Skewness Coefficients and Kurtosis Coefficients for the Tripod 7C's Scales for Grade 5 Students during the 2009 – 2010 and 2010 – 2011 School Years

Scale	2009-2010			2010-2011		
	N	Skewness Coefficient	Kurtosis Coefficient	*N*	Skewness Coefficient	Kurtosis Coefficient
Care	1230	-1.22	1.60	928	-1.04	0.73
Control	1299	-0.42	0.20	974	-0.44	0.02
Clarity	1246	-1.31	2.91	921	-1.23	2.11
Challenge	1206	-0.74	0.18	936	-1.06	1.06
Captivate	1283	-0.40	-0.17	973	-0.54	0.10
Confer	1255	-1.08	2.07	948	-1.32	2.70
Consolidate	1307	-0.57	-0.21	979	-0.67	-0.04

Prior to performing the multiple linear regression analysis, a series of Pearson's product moment correlation coefficients (i.e., Pearson's r) were calculated to determine the relationship between mathematics scores and the seven independent variables—care, control, clarity, challenge, captivate, confer, and consolidate. The Bonferroni correction was applied to control the error rate of the seven computed correlation coefficients of the independent variables, so that the total experimentwise error rate did not exceed 5% (e.g., Chandler, 1995; Ho, 2006; Manly, 2004; Vogt, 2005). This correction was determined by dividing the nominal alpha value by 7 (i.e., .05/7 = .007). Therefore, the adjusted level of statistical significance was .007. Including the Bonferroni adjustment, the series of Pearson's *r* revealed that for the 2009-2010 school year, there were two statistically significant relationships. Specifically, mathematics scores were statistically significantly related to control (r [1284] = .16, $p < .000$) and consolidate (r [1291] = -.15, $p < .000$). For the 2010-2011 school year, there were two statistically significant relationships. Specifically, mathematics scores remained statistically significantly related to control (r [949] = .09, $p < .005$) and clarity (r [898] = .11, $p < .003$). Based on Cohen's (1988) effect size criteria, the relationships involving control and consolidate were small for Year 1. For Year 2, the relationships involving control and clarity had a small effect size. Moreover, of the two relationships, the association between mathematics scores and control was the largest in Year 1 and the association between mathematics scores and clarity was the largest in Year 2.

An all possible subsets (APS) multiple linear regression (Onwuegbuzie & Daniel, 2003; B. Thompson 1995) again was utilized. The R^2 values for the multiple linear regression models for the 2009-2010 and 2010-2011 school years are displayed in Table 37 multiple linear regression model with the largest R^2 value was the seven-variable model encompassing all the independent variables (R^2 = .088) for Year 1 of this study. Again, the multiple linear regression model with the largest R^2 value was the seven-variable model encompassing all the independent variables (R^2 = .038) for Year 2 of this study. The model fit then was examined.

Table 37

R^2 Values for the Multiple Linear Regression Models Encompassing Year 1 and Year 2 of the Study with Grade 5 African American Boys

Multiple Linear Regression Model	Year 1 - R^2	Year 2 - R^2
Seven-Variable Model: Care Control Clarity Challenge Captivate Confer Consolidate	.088	.038

For the seven-variable model for Year 1 and Year 2 of this study, the following information is presented in Table 38 and Table 39: the unstandardized regression coefficients and intercept, the standard error of the unstandardized coefficients, the standardized regression coefficients, the structure coefficients, the semi-partial correlations, the partial correlation coefficients, the squared multiple correlation coefficient (R^2) of the chosen model, the tolerance statistics, the variance inflation factors, and the condition numbers. This particular model indicated that care, control, clarity, challenge, captivate, confer, and consolidate contributed statistically significantly (F [7, 927] = 12.62, $p < .0001$) to the prediction of overall mathematics scores for Year 1. In Year 2, the seven-variables model indicated that care, control, clarity, challenge, captivate, confer, and consolidate contributed statistically significantly (F [7, 752] = 4.23, $p < .0001$) to the prediction of overall mathematics scores. However, these seven variables combined to explain 8.8% of the variation in mathematics scores for Year 1 and 3.8% for Year 2. According to Cohen (1988), for regression models in the social and behavioral sciences, R^2 values between 2% and 12.99% suggest small effect sizes, values between 13% and 25.99% indicate moderate effect sizes, and values of 26% and greater suggest large effect sizes. The R^2 values of 8.8% and 3.8% for Year 1 and Year 2 of this study, respectively, represented a small effect size, which is consistent with the correlation coefficient. Thus, the selected final model represented a very small effect size for both years.

Table 38

Selected Multiple Regression Model for Predicting Grade 5 African American Boys' Mathematics Scores in Year 1

Variable	Regression Coefficient	Standard Error	*t* Value	Standard Regression Coefficient	Structure Coefficient	Squared Part	Squared Partial	Tolerance	VIF	Condition
Intercept	-.61	.23	-2.70							1.00
Care	.01	.01	0.70	.04	.01	.02	.02	.33	2.99	12.83
Control	.06	.01	5.07	.19	.15	.16	.17	.74	1.36	14.60
Clarity	.03	.01	3.06	.17	.05	.10	.10	.31	3.27	18.19
Challenge	.00	.01	0.35	.01	-.00	.01	.01	.70	1.43	20.99
Captivate	-.02	.01	-2.30	-.09	-.06	-.07	-.10	.63	1.59	23.88
Confer	-.01	.01	-0.89	-.05	-.03	-.03	-.03	.30	3.29	34.47
Consolidate	-,12	.02	-6.44	-.28	-.16	-.20	-.21	.54	1.84	39.85

Note.
VIF = Variance Inflation Factor
Part = Semi-Partial Correlation Coefficient
Partial = Partial Correlation Coefficient

Model R^2 = .088, F [7, 927] = 12.62, $p < .0001$

Adjusted R^2 = .081

*$p < .05$, **$p < .01$, ***$p < .0001$

Table 39

Selected Multiple Regression Model for Predicting Grade 5 African American Boys' Mathematics Scores in Year 2

Variable	Regression Coefficient	Standard Error	*t* Value	Standard Regression Coefficient	Structure Coefficient	Squared Part	Squared Partial	Tolerance	VIF	Condition Index
Intercept	-.29	.24	-1.18							1.00
Care	.01	.01	0.60	.04	.07	.02	.02	.33	3.07	14.16
Control	.03	.01	1.92	.08	.10	.07	.07	.67	1.45	16.47
Clarity	-.05	.01	3.87	.27	.11	.14	.14	.27	3.70	17.82
Challenge	-.01	.01	-0.48	-.02	.03	-.02	-.02	.68	1.47	22.69
Captivate	-.02	.01	-1.38	-.07	.01	-.05	-.05	.59	1.70	23.33
Confer	-.04	.01	-3.04	-.20	.00	-.11	-.11	.30	3.30	33.54
Consolidate	-.02	.02	-0.93	-.05	-.00	-.03	-.03	.51	2.00	41.57

Note.
VIF = Variance Inflation Factor
Part = Semi-Partial Correlation Coefficient
Partial = Partial Correlation Coefficient

Model $R^2 = .038$, F [7, 752] = 4.23, $p < .000$

Adjusted $R^2 = .029$

$^*p < .05$, $^{**}p < .01$, $^{***}p < .001$

In consideration of the assumptions for the selected seven-variable multiple linear regression model, the Durbin-Watson coefficient of 1.92 for Year 1 and 1.91 for Year 2 was sufficiently close to 2, which suggested that for any two observations, the residual terms were uncorrelated (i.e., lack of autocorrelation). Furthermore, the absence of auto correlation in the seven-variable multiple linear regression model was a desirable outcome. Both the histogram of the standardized residuals and the normal probability plot (not presented) suggested that the residuals in the model were normally distributed and linear based on the bell-shaped curve and straight line observed, respectively. This observed data satisfied the assumption of normality and linearity, which are associated with multiple linear regression. Further, the scatterplot of both the standardized residual against the standardized predicted value (not presented) and studentized residual against the standardized predicted value (not presented) suggested that the assumption of random errors and homoscedasticity were met. In addition, an examination of the standardized residuals pertaining to each of the participants in Year 1 revealed that 20 participants had standardized residuals that exceeded the absolute value of 2.00, which represented 2.16% (i.e., 20/927) of the total sample. In Year 2, 19 participants had standardized residuals that exceeded the absolute value of 2.00, which represented 2.53% (i.e., 19/752. Nevertheless, the number of participants with large standardized residual in both years of the study is less than the 5% expected by chance, which suggested little cause for concern.

An inspection of the tolerance statistics, the variance inflation factors, and the condition indices of the selected regression model for both years (cf. Table 38 and Table 39) indicated that no multicollinearity was present. In particularly, the variance inflation factors, which denote the extent that the variance of an individual regression coefficient has been inflated by the presence of collinearity, were much lower than 10, emphasizing little evidence of multicollinearity (Myers, 1986). Actually, the variance inflation factors were relatively close to 2.00, which indicated no relationship existed among the seven independent variables. Condition indices, which represent the ratio of the largest to the smallest eigenvalues, also provided information about the strength of linear dependency among the independent variables. From Table 38 and Table 39, the condition indices were much less than 1,000 (Myers, 1986), reiterating the fact that multicollinearity was not present. In addition, the tolerance statistics were greater than 0.2 (Field, 2009), which also indicated a lack of multicollinearity.

From the partial and semi-partial correlation coefficients (Table 38 and Table 39), it can be seen that control and consolidate were the highest predictors of mathematics scores for Year 1 of the study; however consolidate was the best predictor. In Year 2 of the study, clarity and control were the highest predictors of mathematics scores; however, clarity was the best predictor. An examination of the structure coefficients (Table 38 and Table 39), using a cutoff correlation of 0.3 recommended by Lambert and Durand (1975) as an acceptable minimum coefficient, suggested that the independent variables did not make important contributions to the model. However, statistical significance does not always correspond to practical significance, and it is important to note that most of the correlation coefficients generated in the social and behavioral sciences, including educational research like my study, are relatively small, between .20 and .40 (Sirkin, 2006). In summary, the selected final regression model indicated that as teachers help students to consolidate mathematics objectives students tend to have lower mathematics scores. The regression equation for Year 1 was as follows: mathematics scores = -0.61 - 0.15*consolidate + 0.02*care + 0.16*control + 0.05*clarity - .01*challenge - .06*captivate -.02* confer. This equation indicated that every 1-point increase in consolidate was associated with a 0.15 decline in mathematics scores. The regression equation for Year 2 was as follows: mathematics scores = -0.29 + 0.10*clarity + 0.04*care + 0.09*control + .00*challenge - .01*captivate - .01* confer - 0.05*consolidate. This equation indicated that every 1-point increase in clarity was associated with a 0.10 increase in mathematics scores. Consequently, every 10-point increase in consolidate was associated with a 1.5 decrease in mathematics scores in Year 1; and for Year 2, a 10-point increase in clarity was associated with approximately a 1.0 increase in mathematics scores.

Summary

Methods of analysis consisted of descriptive and inferential statistics, including multiple linear regression, correlation procedure, and Pearson's *r* statistical procedure. Effect sizes were calculated for all relationships and differences in which statistical significance was present. Statistical significance at the .000 alpha level was revealed between mathematics scores and consolidate for the first research question concerning Grade 4 African American boys in Year 1. In Year 2, statistical significance at the .002 alpha level was between mathematics scores and consolidate. With the second research question concerning Grade 5 African American boys, statistical significance at the .000 alpha level was between mathematics scores and control and mathematics scores and consolidate for Year 1. For Year 2, statistical significance at the .005 alpha level was between mathematics scores and control. Additionally, statistical significance at the .003

alpha level was also between mathematics scores and clarity during Year 2. An evaluation of effect sizes revealed that practical significance existed in the statistically significant relationships between mathematics scores and consolidate, mathematics scores and control, and mathematics scores and clarity in the current study. Data used for this process consisted of the Tripod 7C's—care, control, clarity, challenge, captivate, confer, and consolidate as the independent variables and mathematics scores as the dependent variable. Presented in Chapter V are: (a) overview and summary of the problem, purpose, significance, and research methodology of the study; (b) discussion of the findings from the study; (c) findings as they relate to the theoretical framework; (d) findings in relationship to the context of the literature; (e) implications for educational practices, and (f) recommendations for further research.

CHAPTER V

Discussion, Implications, and Recommendations

Chapter V is divided into six sections. The first section is a summary of the problem, purpose, and significance of the study. Next, is an overview and a discussion of the findings. The third section consists of a discussion of the findings in relationship to the theoretical framework. The fourth section involves a discussion of the findings in the context of the current literature. The fifth section consists of implications of the findings for current educational practices. Finally, recommendations for future research are presented.

Summary

Education is the way out of poverty (Darling-Hammond, 2006; Douglas-Hall & Chau, 2007; National Council of Teachers of Mathematics [NCTM], 2011; Valverde & Näslund-Hadley, 2010). Yet, according to the National Center for Children in Poverty (NCCP), the majority of students who come from low-income families have parents who have no college degrees (Douglas-Hall & Chau, 2007). Importantly, many African American children have been raised in single-parent homes and live below the poverty level (Parham, Ajamu, & White, (2011/2016). Semega, Fontenot, and Kollar (2017) estimated that more than 26% of African American families were living below the poverty level, compared to 11% of White families living below the poverty level.

To find ways to support and to prepare African American students and other students of color for post high school, the Virginia Department of Education implemented the College Career and Readiness Initiative (Garland et al., 2011). The researchers determined that students with the highest probability of success in postsecondary institutions were those who scored at the advanced levels on their high school end-of-course mathematics and English Standards of Learning (SOL) assessments (Garland et al., 2011). However, many African American students struggle in mathematics. Based on the results of the 2011 NAEP Fourth-Grade Mathematics Subtest, Grade 4 African American students' average scaled scores were 25 points lower than those of White students (NCES, 2011). This gap in mathematics achievement further increased for African American Grade 8 students in comparison to their White counterparts by an average scaled score of 31 points. At present, the results of the NAEP assessments for 2017 continue to confirm the disproportionality of academic achievement in mathematics by African American children in comparison to White children at the same age and grade level. More importantly, Grade 4 White students' mathematics scores have remained constant since 2015, whereas mathematics scores of Grade 4 African American students are on the decline (NAEP, 2017).

Additionally, a large number of African American boys have been diagnosed with Attention Deficit Hyper-Activity Disorder (ADHD) and might engage in behaviors of opposition and aggressiveness (Kunjufu, 2011). Needless to say, these types of behaviors impact the learning achievement of many African American boys because some teachers might have less tolerance for working with students who do not possess teachers' preferred student-qualities—compliance and cooperation (Brophy & Good, 1974; Wilkins, 2014). Roderick (2003) reported that ninth-grade teachers viewed African American boys more negatively than the other students. Although African American children struggle as a whole in mathematics compared to their White peers, African American boys perform below African American girls and other boys. Moreover, African American boys are less likely to be provided an opportunity to learn in ways that complement their learning characteristics (Kunjufu, 2011) and are also less likely to benefit from mathematics instruction in both urban and suburban classroom environments (Ramirez & Carpenter, 2005).

In the literature, there have only been a few qualitative research studies conducted on fourth- and fifth- grade African American boys' attitudes of teacher-student relationships and their achievement in mathematics at the elementary level, and no quantitative studies have been conducted on the same population of students. Thus, the purpose of the present 2-year longitudinal retrospective investigation was to determine, using quantitative data, whether there was indeed a relationship between fourth- and fifth-grade African American boys' attitudes of teacher-student relationships and their mathematics achievement. Data from the Measuring Effective Teachers (MET) project conducted from 2009 through 2011 and sponsored by the Bill and Melinda Gates Foundation (2013a) were utilized in this study. The participants were 2,468 Grade 4 African American boys and 2,739 Grade 5 African American boys enrolled in five large, urban school districts across the United States. Archived data comprised the individual responses of the participants from the Tripod 7C's survey and the mathematics scores from state tests (Bill and Melinda Gates Foundation, 2013a). In addressing the research questions, the statistical method utilized was multiple regression. The independent continuous variables came from the 7Cs survey and comprised care, control, clarify, challenge, captivate, confer, and consolidate. The dependent variable in this study was the mathematics state test scores. Several assumptions for multiple regression models were met prior to being appropriately applied to the population of interest in that the coefficients and parameters of the regression equation were not influenced by one another.

The results from this 2-year longitudinal research study adds to the body of literature by providing insights regarding the relationship between African American fourth- and fifth-grade boys' attitudes of teacher-student relationships and their mathematics achievement.

Discussion of Findings in Context of the Literature

My study was guided by the following research questions:

1. What is the relationship between fourth-grade African American boys' attitudes toward teacher-student relationships and their mathematics achievement?

2. What is the relationship between fourth-grade African American boys' attitudes toward teacher-student relationships and their mathematics achievement?

The statistical method utilized was multiple regression. Prior to performing the multiple linear regression analysis, a series of Pearson's product moment correlation coefficients (i.e., Pearson's *r*) was calculated to determine the relationship between mathematics scores and the seven independent variables—care, control, clarity, challenge, captivate, confer, and consolidate. The Bonferroni correction procedure was applied to control the error rate of the seven computed correlation coefficients of the independent variables, so that the total experimentwise error rate did not exceed 5% (e.g., Chandler, 1995; Ho, 2006; Manly, 2004; Vogt, 2005). An all possible subsets (APS) multiple linear regression (Onwuegbuzie & Daniel, 2003; B. Thompson 1995) was utilized. By incorporating the APS technique, which is advocated by a number of statisticians (e.g., Onwuegbuzie & Daniel, 2003; B. Thompson 1995), all possible models comprising some or all of the independent variables were inspected to ascertain the best subset of independent variables conferring to Cohen's (1988) criterion of the maximum proportion of variance explained (R^2), which represents the effect size. Effect sizes were calculated when statistically significant findings were demonstrated.

Summary of results for Research Question 1: What is the relationship between fourth-grade African American boys' attitudes toward teacher-student relationships and their mathematics achievement? The findings for Research Question 1 indicate that only two of the seven independent variables (i.e., care, control, clarity, challenge, captivate, confer, and consolidate) impacted the mathematics scores. The variables, control and consolidate, in Year 1 of the study had a statistically significant impact on mathematics scores, although their effect sizes were small. Of the two variables, consolidate had a greater influence. In Year 2, consolidate was the only variable that had a statistically significant, yet small, impact on mathematics scores.

Control positively related to increased mathematics scores. When teachers are able to engage students by meeting the needs of diverse learners through differentiated instruction, students are more likely to attend and to take ownership of their learning during the learning process. This finding is supported in the literature. Positive teacher emotions can support students' enjoyment of learning within the classroom and can have long-term effects on the value of learning perceived by students (Caine & Caine, 1990; Pekrun, 2014). According to Pekrun (2014), the cognitive and motivational quality of classroom instruction is necessary for students' emotional buy-ins or feelings of tasks worthiness in relationship to learning. Teachers' pedagogical knowledge (Darling-Hammond, 2006; Ertmer, 2003; R. Ferguson, 2012; Hill & Lubienski, 2007; Kane &

Staiger, 2010, 2012; Porter & Brophy, 1988; Shulman, 1987; Zimmerman et al., 1992) and teacher behaviors-structure (Shulman, 1987), clarity (Chesebro & McCroskey, 2001; Christophel, 1990; Comadena et al., 2007; Frymier et al., 1996; Houser & Frymier, 2009; Mottet et al., 2008; Walker & McCoy, 1997/2013) , task difficulty (Pekrun, 2014; Shulman, 1987), and the match between task difficulty and students' competencies are effective in students' learning and teachers maintaining control of the classroom (Pekrun, 2014; Shulman, 1987).

Additionally, findings from the study indicated that consolidate had an inverse relationship to mathematics scores. That is, the more teachers consolidated students' learning by helping them to summarize and to apply the learning task and by providing feedback on students' work, the more mathematics scores declined. Several underlying causes might have contributed to the inverse relationship between consolidate and mathematics scores. First, Shulman (1987) and other researchers (Darling-Hammond, 2006; Ertmer, 2003; R. Ferguson, 2012; Hill & Lubienski, 2007; Kane & Staiger, 2010, 2012; Porter & Brophy, 1988; Zimmerman et al., 1992) believe that teachers must have in-depth knowledge about the objective to be taught and the processes of learning to help students consolidate or make connections in what they learned in class to the real world. According to Kane and Staiger (2010), based on fourth- and fifth-grade classrooms participating in the MET study, those classes which overall survey scores were in the 25th percentile and 75th percentile, had a positive response rate of approximately 50% and 74%, respectively, to the statements on the consolidate scale: "My teacher takes the time to summarize what we learn each day" and "When my teacher marks my work, he/she writes on my papers to help me understand" (p. 12).

Of concern, is the finding that 26% to 50% of students did not believe that the teachers helped them to consolidate their learning. Fernandez (2005) found in her study on mathematics teachers in Grades 2-5 that teachers lacked a deep enough understanding of the mathematics covered in their lessons to speculate on potential problems that students would have in understanding the teaching of the concept of fractions. This finding has been somewhat typical of U.S. teachers often knowing little about how best to teach particular concepts of mathematics and having difficulty delivering instruction that is responsive to the mathematical challenges that emerge when their students are asked to solve rich problems and to share their thinking about them (Ball & Bass, 2000; Shellard, 2004). Researchers have documented that struggling learners have traditionally received little instruction in mathematics conceptual understanding (Helwig, Anderson, & Tindal, 2002; Pogrow, 2009; Shellard, 2004). In the researcher's previous role as an academic trainer working with teachers in mathematics, these teachers viewed mathematics instruction as "telling" students what to do instead of providing them rich hands-on experiences using manipulatives to teach mathematical concepts. One specific skill that students benefit using manipulatives from is that of subtracting when they use base-10 blocks to regroup or rename quantities. Without assistance, teachers were not able to demonstrate the underlying concept of subtraction. Moreover, the teachers believed that using the manipulatives and having students use the academic language would take too much time and students would have fun throwing the manipulatives at one another. It is understandable why various entities connect students' capabilities in mathematical literacy to the teachers of mathematics. Coleman et al. (1966) and Jencks (1972) also documented that students who had knowledgeable teachers were more successful academically than were those who did not. Furthermore, Bandura (1997), advocated that teachers' self-confidence in their teaching skills is associated with their professional behavior and students' performance and motivation.

Secondly, the inverse relationship between consolidate and mathematics scores might be attributed to how teachers communicate with their students and the level of encouragement that they provide to their students. From Mottet et al.'s (2008) study of students' perceptions of their teachers' instructional communication behaviors, the researchers observed that students' perceptions of their mathematics/science teachers' use of nonverbal immediacy, clarity, and content relevance was significantly more negative than of other teachers not teaching mathematics/science (i.e., English Language Arts). Mottet et al. (2008) also noted that there were significantly more disconfirmation (e.g., criticism, put-downs, and impatience) behaviors among mathematics/science teachers compared to other teachers (Mottet et al., 2008). Teachers' behaviors such as these might be viewed as a contributing factor of students' inabilities to learn mathematics (Chesebro & McCroskey, 2001; Frymier et al., 1996; Houser & Frymier, 2009). However, communication flows both ways and students might experience an array of emotions such as happiness, sadness, frustration, surprise, and disappointment (Caine & Caine, 2011; Jensen, 2009; Jones et al., 2013). Stemming from situations (e.g., diet and physical health, fatigue, emotional health, and environmental factors) occurring outside the classroom or during the learning process, emotions might impede students' ability to focus on learning.

Another possible reason for the inverse relationship between consolidate and mathematics scores is the disposition of some African American boys. A large number of African American boys have been diagnosed with ADHD and might engage in behaviors of opposition and aggressiveness (Basch 2011; Kunjufu, 2011). Some of the opposing and aggressive behaviors of some of the African American boys experienced by the researcher in her current role as a Grade 4 teacher in a self-contained classroom are: (a) initial push back on learning new mathematics objectives involving more than two steps such as subtraction or division skills, (b) unwillingness to explain or show evidence of their solutions while working independently to internalize learning and to build stamina, (c) experience high levels of frustration when an answer is incorrect requiring a passage of time before accepting an explanation, (d) demand attention with little regard for their peers, (e) evade other students' space, and (f) difficulty with delayed gratification due to impulsivity. Needless to say, these types of behaviors impact the learning achievement of many African American boys because some teachers might have less tolerance for working with students who do not possess teachers' preferred student-qualities—compliance and cooperation (Brophy & Good, 1974; Wilkins, 2014). Additionally, instructional time is sacrificed because learning is impacted by negative emotions (Pekrun, 2014; Jensen, 2009). According to Jensen (2009), when the emotional needs of students are met, then teaching and learning can happen. Hodgen and Marks (2013) emphasized that for students of poverty to benefit from attending post-secondary institutions and to obtain higher paying jobs, might depend on the mathematics skills they have developed from Kindergarten through 12th Grade. In other words, these students must be mathematical literate. Yet, some of these African American boys are missing out on building their mathematics foundation skills that they will need to sustain them in middle school and beyond high school.

Summary of results for Research Question Two: What is the relationship between fifth-grade African American boys' attitudes toward teacher-student relationships and their mathematics achievement? The findings for Research Question 2 indicate that three of the seven independent variables (i.e., care, control, clarity, challenge, captivate, confer, and consolidate) impacted mathematics scores. The variables, control and consolidate, in Year 1 of the study had a statistically significant impact on mathematics scores, although their effect sizes were small. Of the two variables, consolidate had a greater influence than did control. Additionally, control had a positive relationship with mathematics scores, whereas consolidate continued to have an inverse relationship with mathematics scores. In Year 2, the variables, control and clarity, had a statistically significant, yet small, impact on mathematics scores. Of the two variables in Year 2, clarity had the greatest impact on mathematics scores. The variables, consolidate and control, have been discussed in the previous section; therefore, connections to the literature with findings on clarity will be discussed. From the findings in this study, clarity had a positive relationship on mathematics scores. Teacher clarity is an essential behavior that drives the learning process and classroom management systems because teachers scaffold learning, model, and help students organize information for learning. Chesebro and McCroskey (2001) determined that students of clear teachers were more likely to be motivated, have positive affect for their instructor and the course, and were likely to perceive that they had learned more cognitively. These findings also have been confirmed by other researchers (e.g., Comadena et al., 2007; Houser & Frymier, 2009).

Discussion of Findings in the Context of the Theoretical Framework

The ecological systems theory in human development is the theoretical framework that was used to drive this study. The theory places students as the central force in shaping environments, inducing feedback from them, and reacting to them with guidance and modeling from adult role models (Darling, 2007). Parents, caregivers, and teachers are primarily the ones who shape and frame children in the primary phases of their lives within their varied settings. Bronfenbrenner (1977/2009) believed that society was the contributing factor that played a crucial role in molding children´s development, and this belief was significant to the construction of his theory. In his understanding, societal norms influenced everything about children to the minutest detail (Härkönen, 2007). The ecological systems theory comprises four levels with distinct environments children experience at different points and at varying degrees throughout their development from infancy into adulthood. These four levels comprise the microsystem, the mesosystem, the exosystem, and the macrosystem.

Bronfenbrenner (1977/2009) referred to the first environment as the microsystem that involves the direct contact that children have in their immediate environments, including home, school church, membership with community groups, and other settings in which children are active participants. Within this system, young people directly interact with others as both giver and receiver in meaningful and engaging ways (Bronfenbrenner, 1977/2009). In this study, clarity was an important characteristic of teachers for fifth-grade African American boys. As mentioned previously, teachers provide step-by-step instructions, model learning expectations, and scaffold information (Chesebro &McCroskey, 2001; Comadena et al., 2007; Houser & Frymier, 2009).

Clarity and mathematics score had a positive relationship. Many African American boys have great verbal skills and might appreciate clear teachers teaching mathematics skills that require higher demands of cognitive thinking. Bronfenbrenner (1977/2009) also believed there was a gradual release or transference of teaching a skill by teachers to students until the students are able to demonstrate their learning independently in that they are able to teach other students. Considering the ecological systems theory might explain why consolidate and mathematics scores had an inverse relationship for fourth- and fifth-grade African American boys alike. It is possible that the gradual release of learning an objective for some students might come too quickly, which does not afford African American boys the time that they need to internalize the skill, thereby setting in frustration for both students and/or teachers due to time allotments (i.e., planning guides, pacing charts) set by a district's Curriculum and Instruction Department. Thus, the way teachers respond and react in various situations are communicated directly to students (Bronfenbrenner, 1977/2009; Jennings & Greenberg, 2009; Roeser et al., 2012). Like Bronfenbrenner (1977/2009), Sylwester (1995) warned educators that their impact on students might not manifest itself through the students on a daily basis, but it does become a part of the "ecology" (p. 140) of students' lives.

The mesosystem, or the second environment, encompasses the relationships among the microsystems in children's lives. The possibility of children's experience in one setting might impact their behaviors in another setting (Bronfenbrenner (1977/2009). In this study, control had a positive relationship with mathematics scores for both fourth- and fifth-grade African American boys. Teachers are faced with the diversity of students entering their classrooms and must provide structure and classroom expectations for a conducive learning environment.

The third environment named by Bronfenbrenner is the exosystem. It refers to "one or more settings that do not involve the developing person as an active participant, but in which events occur that affect, or are affected by, what happens in the setting containing the developing person" (Bronfenbrenner, 1977/2009, pp. 23-24). Although not a part of the current study, in the original MET study, teachers were provided training and coaching in teaching mathematics (Bill and Melinda Gates Foundation, 2013a; Kane & Staiger, 2010). These teachers were also video-taped teaching mathematics lessons and were provided constructive feedback about their lessons and students' engagement (Bill and Melinda Gates Foundation, 2013a; Kane & Staiger, 2010). In Year 1 of the MET study, consolidate negatively impacted mathematics scores with fourth-grade African American boys, whereas in Year 2 of the MET study, clarity positively impacted mathematics scores with these same students now in fifth-grade. The professional development in mathematics instruction received by teachers might have enhanced their abilities to engage African American boys in the learning process. Consolidate in Year 2 of the MET study continued to have an inverse relationship with mathematics scores of fourth-grade African American boys, although the impact was not as significant in Year 2 as in Year 1, again attributing this improvement with professional development received by teachers of these students.

The macrosystem is the fourth and final environment. Bronfenbrenner (2009) referred to it as,

> …consistencies, in the form and content of lower-order systems (micro-, meso-, and exo-) that exist, or could exist, at the level of the subculture or the culture as a whole, along with any belief systems or ideology underlying such consistencies (p. 24).

Different belief systems and lifestyles influence and promote the ecological environments specific to each culture (Bronfenbrenner, 1977/2009). Archived data in the form of state tests mathematics scores were used in the present study. Under the NCLB Act of 2001, states were mandated to test students in reading and mathematics in Grades 3 to 8 and once in high school to receive federal funding for their educational programs (Klein, 2016). Another requirement of the law was for states to bring all students to the proficient level on state tests by the 2013-2014 school year (Klein, 2016). Test results of schools receiving federal funds were reported annually and monitored through the AYP system to track progress or lack of progress toward meeting the proficient level. The state assessments were used to measure the degree to which students had learned and were able to use the pre-determined knowledge and skills at each tested grade level (Colorado Department of Education [CDOE], 2010, 2011; Florida Department of Education [FDOE], 2010, 2012; New York State Education Department [NYSED], 2010, 2011; North Carolina Department of Public Instruction [NCDOPI], 2008); Tennessee Department of Education [TDOE], 2010, 2011) that led to central and camp leaders promoting *teaching to the test* to ensure that their districts and schools met AYP that confined teachers to only teaching what was tested with disregard to the necessary perquisite skills. For example, during an Admission-Review Dismissal meeting held for a student receiving Special Education services, one third-grade teacher in a previous school setting of the researcher explained to a parent that she was teaching elapsed time because that was a state requirement for third-grade students and that she did not have time to teach the student how to tell time, which was a second-grade skill. This comment from the teacher was affirmed by the assistant-principal, thereby indicating the importance of covering the curriculum as opposing to meeting students' needs.

Implications for Educational Practices

Across the Unites States, present conditions do not afford many African American boys the opportunity to receive mathematics instruction in settings conducive for the development of their mathematical literacy skills. These African American boys continue to lag behind their peers on national mathematics assessments and, as recently as 2017, their mathematics scores have declined with respect to other students in the same grade (NAEP, 2017). It is imperative for African American boys to be provided with the necessary resources and tools that support and promote a strong mathematics foundation, so that they too will have the necessary sustaining skills to compete in the global job market.

The results of this study in examining African American boys' attitudes about their teacher-student relationships and their mathematics achievement were supported by findings from previous studies. At some point in this 2-year, retrospective study educating fourth- and fifth-grade African American boys, control, clarity, and consolidate impacted their mathematics scores. My research study has many implications of educating African American boys for teacher preparation programs, district leaders and campus administrators, teachers, African American parents, and African American boys.

Teacher preparation programs. Based on the latest mathematics scores from *The Nations Report Card,* U. S. students' scores overall have remained constant, with African American students' scores on the decline (NAEP, 2017). According to Schmidt, Cogan, Houang, and McKnight (2009), it is not enough for teachers to know how to do mathematics, but they must receive specific instruction in the teaching of mathematics to diverse learners. Mathematical literacy with its many components and cognitive demands on the brain is a daunting subject to teach and to ensure mastery of skills by students. Individuals coming into the field of education to teach Pre-kindergarten through sixth-grade students should be competent in teaching basic mathematics skills (e.g., mental mathematics, estimations, statistics and probability, number concepts, basic operations, interpreting graphical representations and diagrams, problem-solving), as these are some of the mathematical skills required for many non-technical jobs in the workplace (Hodgen & Marks, 2013). By having a strong skill set in mathematics, teachers will be able to help students make connections and find mathematics more meaningful. Incoming teachers also should be required to enroll in mathematics methodology courses to develop a repertoire of strategies to use in transferring their knowledge in a way diverse learners are able to learn and to apply that knowledge successfully. Other researchers (i.e., Brophy & Good, 1974; Darling-Hammond, 2006; Darling-Hammond, Holtzman, Gatlin, & Heilig, 2005; Kuenzi, 2008; Shulman, 1987) agree that mathematics training preparations and/or professional development designed to inform teachers of mathematics with research-based strategies and tools required to develop students' mathematical literacy skills are in need of improvement.

District leaders and campus administrators. With federal government holding states and school districts accountable for students' academic achievement, district leaders and campus administrators are under pressure to ensure that all students receive exposure to curriculum standards required at each grade level. As a result, teachers are held accountable for focusing daily instruction on what is tested on the state assessments per the district's pacing calendar. Unfortunately, this pacing of instruction established by district personnel and enforced by school leaders does not take into account the needs of individual students who are 2 years or more below grade level or those students who need behavioral and/or emotional supports. Thus, students are experiencing higher levels of anxiety due to high-stakes testing in today's classrooms over skills that many students have not had enough time on task or experiences to internalize and to use the mathematical knowledge in daily experiences. When planning the pacing of the curriculum calendar, district personnel should take into consideration the needs of students who need pre-requisite skills and extended time to consolidate their learning. However, the pacing calendar and benchmark testing are designed for students who are at or near grade level. Yet, there is no distinction or alternate testing schedule for students with varying mathematics abilities. One size fits all and all students are required to take the district and school assessments which further frustrates students and increases test anxiety (Pekrun, 2014). For African American boys, they need to use all of their senses to learn in that they need to hear instruction, see the task modeled, create muscle memory by manipulating the learning tools, and sub-vocalize learning for it to register on their brains (Jensen, 2009; Kunjufu, 2011). Some African American boys have challenging behaviors that are different from the types of students' characteristics that teachers find enjoyable to teach. These teachers need to be provided professional development in culturally relevant teaching and support in working with many African American boys (Ladson-Billings, 1990, 1995; Leonard & Martin, 2013; Tate, 1995/2009; Warren, 2017).

Teachers. It is of utmost importance for teachers of mathematics to know and be able to perform mathematics. Shulman (1987) advised that flexible and interactive teaching methods might not be available to teachers when they lack the understanding of the concept to be taught. In this study, teacher clarity and control were significantly related to mathematics scores. Houser and Frymier (2009) explained, “When teachers are clear, they do things like use previews and summaries, they stress important points, use visual aids, and help students prepare for assignments” (pp. 48-49). In Kunjufu’s (2011) work with African American boys, he noted that these students possess strengths in their auditory skills, oral skills, visual-picture skills, and tactile/kinesthetic skills. One way for teachers to engage African American boys in mathematics lessons and to manage the class is to incorporate the strengths of African American boys in the planning for and implementation of instructional activities (Kunjufu, 2011). Other ways suggested by Kane and Staiger (2010, 2012) include teachers using humor, questioning, guided practice, modeling, multimedia presentations, group work, discovery and inquiry, and project-based learning in context of their communities (Ladson-Billings, 1995) that provide opportunities for students to be challenged at various levels. African American boys need teachers whose mission it is to teach in that these teachers want and are willing to do whatever it takes to help this body of students excel in school and life, despite the fact that some of these boys require a level of energy that might not be needed of those students who are more compliant and cooperative.

Parents. Parents of African American boys should reflect and take positive action on how they promote learning and reinforce behaviors at home. Although it is not the parents' duty to know how to teach their African American boys to read, to write, or to solve mathematics problems, it is the parents' role to know their boys' strengths, affinities, and challenges in order to advocate for their sons by sharing such information with school personnel, specifically, the teachers. These parents should support learning in their sons' classrooms by partnering with school personnel to find ways to best help their boys with school work at home and to establish consistencies with managing behaviors as necessary. Bronfenbrenner (2009) declared that students learn from watching and interacting with adults and other peers. Parents of African American boys need to stress to their boys that it is not okay to repeat inappropriate behaviors that they see engaged in by their peers. Based on the works of A. Ferguson (2001), in school African American boys' mischievous deeds are not viewed by school personnel as being naturally naughty like many of the African American boys' counterparts. Instead African American boys' behaviors are perceived as disrespectful and toxic to the learning environment that must be controlled (A. Ferguson, 2001). It is apparent that many African American boys have been diagnosed with ADHD and might experience opposition and aggressiveness (Kunjufu, 2011). To help them survive in school, parents of African American boys must make sure these boy have a balanced diet (Basch, 2011), and they must teach their sons how to conduct themselves appropriately in various settings, also known as code switching (Levine, 2002). The behavior of these boys demonstrated in their homes, schools, or communities might not be appropriate in the classrooms where teachers are working to provide conducive learning environments to 22+ students.

Students. African American boys should understand that having mathematical literacy skills are important to securing employment in higher paying jobs and that many of these mathematics skills might be acquired through a compensatory education (K-12th grade). In the classroom, these boys should adhere to the classroom expectations set for following: rules, class routines, and communication of needs. Additionally, African American boys should utilize instructional time efficiently by attending to and participating in the learning process of various mathematics objectives, by being aware of their emotional states and by using a positive approach to managing their behaviors associated with the emotions they experience. In light of the fact that many African American boys score below their peers in mathematics across the country, there are many African American boys who have been successful in their mathematics achievement (Berry 2005; Kunjufu, 2011; Ladson-Billings 1990, 1995; Walker & McCoy, 1997/2013). With support from their parents, teachers, school leaders, and peers, African American boys should choose to make the choice to use their strengths and affinities to learn mathematics skills to become mathematical literate and pursue advanced mathematics courses (Hines, 2017).

Recommendations for Future Research

The primary goal of my retrospective, longitudinal study was to examine the relationship between Grades 4 and 5 African American boys' perceptions of their teacher-student relationships and their mathematics achievement. Archived data from the MET study were used. From the few studies conducted on African American boys

(Ladson-Billings, 1990, 1995; Leonard & Martin, 2013; Tate, 1995/2009; Warren, 2017), the findings from my study were supported by previous studies in the literature. In the plight of helping African American boys experience mathematics success, I have several recommendations for future research.

My study was a quantitative study using African American boys in the elementary setting. Further analysis of the relationship between African American boys' perception of their teacher-student relationships and their mathematics achievement on state tests could be extended to African American males in the secondary setting. According to Lopez (2010), student engagement peaked during elementary school as students were more involved in the learning process; however, through middle school, students' participation in class activities decreased. Therefore, additional research might include a comparison of elementary and middle school African American boys' perception of their teach-student relationships and their mathematics on achievement on state tests.

Moreover, students are constantly and actively appraising and assessing their classroom environments (Blumer, 1980). They make meaning of their interactions or lack of interactions with their teachers and other classmates. Therefore, another recommendation for future study is to capture the voices of African American boys who have not experienced mathematics achievement in school through qualitative research studies.

The NCTM (2011) strongly affirms that teachers and what they do in the classroom are at the heart of promoting the quest for mathematics understanding and using mathematics in school and in life. Yet, like students, their voices also need to be captured. Finally, a recommendation for future studies is to interview teachers on how they believe they can best be supported in helping African American boys develop mathematical literacy.

Conclusion

The results of this study were similar to findings of recent literature with respect to the relationship between African American boys' attitudes of their teacher-student relationships and their mathematics achievement on state tests. Additionally, the results of this study added to the present body of knowledge by examining teacher qualities that African American boys perceive as impacting their mathematics achievement. From the results of this study with Grades 4 and 5 African American boys, positive relationships existed involving control and clarity with mathematics scores, while there was a negative relationship between consolidate and mathematics scores.

The gravity on school districts to meet the demands of national and state accountability in mathematics will continue to be ever present because the economy of our nation depends on how our students are prepared to compete in the workplace. Thus, the pressure spirals downward from district and campus administrators to the teachers and is passed on to students through more testing and less teaching. Learning mathematics is a series of building blocks where one skill builds on top of another. African American boys need many experiences over time to internalize mathematics concepts and to apply them in their daily lives. Moving quickly through the curriculum to ensure that all mathematics objectives are taught and failing to provide African American boys the time they need to grasp the various objectives causes undo stress that further impedes the learning process (Caine & Caine, 2011; Jensen, 2009; Pekrun, 2014).

For some African American boys who have been diagnosed with ADHD, this race to cover the curriculum can be more overwhelming and frustrating, causing them to shutdown losing valuable instructional time necessary for successful achievement in mathematics. Therefore, it is imperative that African American boys need to be in learning environments that are conducive to meeting their needs in that they need experienced and skilled mathematics teachers who know how to manage the classroom and are clear when teaching mathematics objectives.

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APPENDIX A

Re: Copyright Request

[redacted]
Thu 3/30/2017 7:38 AM
To: Bullock, Corina <ckb015@SHSU.EDU>;

Dear Ms. Bullock,

Thank you for your email. As author of the article and Co-Editor and Co-publisher of *Research in the Schools*, you are permitted to reproduce Figure 1 from my article entitled, "Expanding the framework of internal and external validity in quantitative research," which was published in *Research in the Schools* (Volume 10, Issue 1, pages 71-90), as long as you provide appropriate credit to the article using the American Psychological Association (APA, 6th Edition; cf. pp. 37-38) format in your dissertation.

Thank you for your interest in my work.

Best wishes for your dissertation.

Warmest regards,

Tony Onwuegbuzie

Anthony J. Onwuegbuzie, Ph.D., P.G.C.E., F.S.S.
Professor, Department of Educational Leadership, Sam Houston State University
Distinguished Visiting Professor, University of Johannesburg
Co-Editor, *Research in the Schools*
Editor-in-Chief, International Journal of Multiple Research Approaches
Licensed Secondary School Teacher
Mixed Methods International Research Association, President (www.mmira.org)

-----Original Message-----
From: Bullock, Corina <ckb015@SHSU.EDU>
To[redacted]
Sent: Wed, Mar 29, 2017 10:41 pm

Subject: Copyright Request

Dear Dr. Onwuegbuzie:

I am currently enrolled in the Educational Leadership Doctoral Program at Sam Houston State University in Huntsville, TX. I am in the process of completing my dissertation, and I would like to request permission to include and/or modify
Figure 1: Major dimensions of threats to internal validity and external validity at the three major stages of the research process on page 75 from your article entitled: Onwuegbuzie, A.J. (2003). Expanding the framework of internal and external validity in quantitative research. Research in the Schools, 10(1), 71-90.

I kindly appreciate your time and consideration in this matter.

Sincerely,

Corina Bullock,
Graduate Student
Sam Houston State University
[redacted]
Email: ckb015@shsu.edu

APPENDIX B

FW: Copyright Request

PACRights@oecd.org
Wed 3/29/2017 6:47 AM
To: Bullock, Corina <ckb015@SHSU.EDU>;
Cc: PACRights@oecd.org <PACRights@oecd.org>;

☒ attachment Visual PISA Mathematics Assessment Components.docx;

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Best regards,

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From: Bullock, Corina [mailto:ckb015@SHSU.EDU]
Sent: 23 March, 2017 11:15 AM
To: Rights, PAC

Subject: Copyright Request

Dear OECD Staff

I am currently enrolled in the Educational Leadership Doctoral Program at Sam Houston State University in Huntsville, TX located in the United States of America. I am in the process of completing my dissertation, and I would like to request permission to include a table published in the following article:

Organization for Economic Co-operation and Development. (2016). PISA 2015 mathematics framework. (In PISA 2015 Assessment and Analytical Framework: Science, Reading, Mathematic and Financial Literacy. Paris, France: OECD Publishing, pp. 63–78. Retrieved from www.oecd-ilibrary.org/content/chapter/9789264255425-5-en

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Exact pages / charts / data to be reproduced:

1. Figure 4.2, Relationship between mathematical processes and fundamental mathematical capabilities, pp. 69-70

2. Construct a visual to summarize information from pages 63-78. Please see attachment-A Visual PISA mathematics Assessment Components

Will you translate the material? no If yes, into which language?

About you:

Name: Corina Bullock

Full address: [redacted]

Email: ckb015@shsu.edu

About your work:

Title: LONGITUDINAL STUDY ON THE RELATIONSHIP BETWEEN AFRICAN AMERICAN BOYS' ATTITUDES OF THEIR TEACHER-STUDENT RELATIONSHIPS AND THEIR MATHEMACTICS ACHIEVEMENT ON STATE TESTS

Number of pages*: 150
Planned publication date : January, 2018
Publisher's name, address: Sam Houston State University, 1806 Avenue J, Huntsville, TX

Print Run*: 4

Public Price*: $0

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Comments (if any):

I kindly appreciate your time and consideration in this matter. Per the email trail below, I did attempt to contact the Copyright Clearance Center.

Sincerely,

Corina Bullock,
Graduate Student
Sam Houston State University
[redacted]
Email: ckb015@shsu.edu

APPENDIX C

RE: Copyright Request (Thread:1581883)

Permissions <permissions@ascd.org>
Mon 3/20/2017 12:27 PM
To: Bullock, Corina <ckb015@SHSU.EDU>;

Dear Corina,

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Thank you for your interest in Educational Leadership and good luck with your dissertation.

Sincerely yours,

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From: Bullock, Corina [mailto:ckb015@SHSU.EDU]
Sent: Sunday, March 19, 2017 7:44 AM
To: permissions@ascd.org

Subject: Copyright Request (Thread:1581883)

Dear Permissions Department of ASCD:

I am currently enrolled in the Educational Leadership Doctoral Program at Sam Houston State University in Huntsville, TX. I am in the process of completing my dissertation, and I would like to include a figure published in the article by Andrew Porter and Jere Brophy entitled "Synthesis of Research on Good Teaching: Insights from the Work of the Institute for Research on Teaching." I am asking permission to include the following in my dissertation: "Figure: Model of Factors Influencing Teachers' Instructions of Their Students in Particular Content (p. 76)".

I kindly appreciate your time and consideration in this matter.

Sincerely,

Corina Bullock,
Graduate Student
Sam Houston State University
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Email: ckb015@shsu.edu

APPENDIX D

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APPENDIX E

Re: Copyright Request

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Fri 11/10/2017 3:06 AM

To:

Bullock, Corina;

Dear Corina,

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Thank you and lots of good luck!

From: Bullock, Corina <ckb015@SHSU.EDU>

Sent: Saturday, November 4, 2017 12:55:07 AM

To: IBE INFO

Subject: Copyright Request

Dear Sir or Madam,

I am currently enrolled in the Educational Leadership Doctoral Program at Sam Houston State University in Huntsville, TX. I am in the process of completing my dissertation, and I would like to request permission to include and/or modify information from the following article:

Pekrun, R. (2014). Emotions and learning. Geneva 20, Switzerland: United Nations: International Bureau of Education. Retrieved from http://iaoed.org/downloads/edu-practices_24_eng.pdf

I plan to include information in table format. Please refer to the attached table with the information (pending your approval).

I kindly appreciate your time and consideration in this matter.

Sincerely,

Corina Bullock,

Graduate Student

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Email: ckb015@shsu.edu

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LONGITUDINAL STUDY ON THE RELATIONSHIP BETWEEN AFRICAN AMERICAN BOYS' ATTITUDES OF THEIR TEACHER-STUDENT RELATIONSHIPS AND THEIR MATHEMATICS ACHIEVEMENT ON STATE TESTS
Instructor name
Corina Bullock--Graduate Student
Institution name
Sam Houston State University
Expected presentation date
Dec 2017
Order reference number
N/A
Billing Type
Invoice
Billing Address
Corina K Bullock
[redacted]

[redacted]
United States
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Total (may include CCC user fee)
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v 1.1

Questions? customercare@copyright.com or +1-855-239-3415 (toll free in the US) or +1-978-646-2777.

APPENDIX F

RE: Copyright Request

Gates Foundation Open Access Publishing <openaccess@gatesfoundation.org>
Wed 3/29/2017 6:50 PM
To: Bullock, Corina <ckb015@SHSU.EDU>;
Cc: Gates Foundation Open Access Publishing <openaccess@gatesfoundation.org>;

Hi Corina,

Thanks for following up.

I received confirmation this morning from both the program team and the legal team that you have permission to use this information in your dissertation.

Let me know if you need any further information.

Best,

Ashley

Ashley Farley
Associate Officer - Open Access Team - Knowledge and Research Services
E openaccess@gatesfoundation.org
Open Access Policy & FAQ's
Bill & Melinda Gates Foundation
www.gatesfoundation.org

From: Bullock, Corina [mailto:ckb015@SHSU.EDU]
Sent: Tuesday, March 28, 2017 8:12 PM
To: Gates Foundation Open Access Publishing <openaccess@gatesfoundation.org>
Cc: Gates Foundation Open Access Publishing <openaccess@gatesfoundation.org>

Subject: RE: Copyright Request

Hi Ashley,

I am following up on the copyright request.

Kindest regards,

Corina Bullock,
Graduate Student
Sam Houston State University
[redacted]
Email: ckb015@shsu.edu

From: Gates Foundation Open Access Publishing
Sent: Tuesday, March 21, 2017 5:39 PM
To: Bullock, Corina
Cc: Gates Foundation Open Access Publishing

Subject: RE: Copyright Request

Dear Corina,

Thank you for your email.

I have deferred your question to foundation staff who worked on the publication. They are currently out of the office until next week and I hope to get you an answer upon their return.

Best,

Ashley

Ashley Farley
Associate Officer - Open Access Team - Knowledge and Research Services
E openaccess@gatesfoundation.org
Open Access Policy & FAQ’s
Bill & Melinda Gates Foundation
www.gatesfoundation.org

From: Bullock, Corina [mailto:ckb015@SHSU.EDU]
Sent: Sunday, March 19, 2017 5:26 AM
To: Gates Foundation Open Access Publishing <openaccess@gatesfoundation.org>

Subject: Copyright Request

Dear Open Access Department of The Bill and Melinda Gates Foundation:

I am currently enrolled in the Educational Leadership Doctoral Program at Sam Houston State University in Huntsville, TX. I am in the process of completing my dissertation, and I would like to request permission to include and/or modify Table 1. Rates of Agreement at the Classroom Level to Tripod Survey Items: Elementary. Modifications would entail only listing the survey items in the following article:

Kane, T. J., & Staiger, D. O. (2010). Learning about teaching: Initial findings from the measures of effective teaching project. Seattle, WA: Bill and Melinda Gates Foundation. Retrieved from http://k12education.gatesfoundation.org/wp-content/uploads/2015/12/Preliminary_Findings-Research_Paper.pdf

I kindly appreciate your time and consideration in this matter.

Sincerely,

Corina Bullock,
Graduate Student
Sam Houston State University
[redacted]
Email: ckb015@shsu.edu

APPENDIX G

Re: Copyright Request

From: permissions <permissions@nctm.org>
Mon 3/27/2017 7:05 AM
To: Bullock, Corina <ckb015@SHSU.EDU>;

Dear Corina,

Thank you for your request. NCTM grants you permission to include and/or modify portions of NCTM's Principles and Standards in your dissertation.

Please cite the material used as "Adapted from Principles and Standards for School Mathematics, copyright 2000 by the National Council of Teachers of Mathematics (NCTM). All rights reserved."

Please let me know if you have any questions.

Sincerely,

Christine Noddin
Publications Assistant
National Council of Teachers of Mathematics

From: "Bullock, Corina"
Date: Friday, March 24, 2017 at 7:39 PM
To: permissions
Subject: Copyright Request

Dear NCTM Staff:

I am currently enrolled in the Educational Leadership Doctoral Program at Sam Houston State University in Huntsville, TX. I am in the process of completing my dissertation, and I would like to request permission to include and/or modify information from the following article:

National Council of Teachers of Mathematics. (2016). Principles, standards, and expectations.

I plan to include information (in table format) that I gathered from the website under the Content Standards and Processing Standards tabs/Grade 3-5 Expectations. Please refer to the attached request and a copy of the information I placed in a table format (pending your approval).

I kindly appreciate your time and consideration in this matter.

Sincerely,
Corina Bullock,
Graduate Student
Sam Houston State University
[redacted]
Email: ckb015@shsu.edu

APPENDIX H

Agreement for the Use of Confidential Data from the Measures of Effective Teaching Longitudinal Database at the Inter-university Consortium for Political and Social Research (ICPSR)

I. DEFINITIONS

A. "Investigator" is the person primarily responsible for analysis and other use of Confidential Data obtained through this Agreement.

B. "Research Staff" are persons authorized by the Investigator's institution, excluding the Investigator, who will have access to Confidential Data obtained through this Agreement. Research Staff include project staff or students conducting dissertation or thesis research.

C. "Participants" are persons, other than Investigator and Research Staff, who will be provided access to Confidential Data by the Investigator. For example, research subjects who will view videos included in the Confidential Data as part of an IRB approved research protocol are Participants for this agreement. Institution is responsible for ensuring Participant compliance with all aspects of this agreement.

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G. "Private Person" means any individual (including an individual acting in his official capacity) and any private (i.e., non-government) partnership, corporation, association, organization, or entity (or any combination thereof), including family, household, school, neighborhood, health service, or institution.

H. "ICPSR" is the Inter-university Consortium of Political and Social Research.

I. "Restricted Data Contracting System" ("RDCS") is the web-based system for data contracts at ICPSR.

J. "Data Security Plan" is a component of this Agreement, found as Attachment A, which specifies permissible computer configurations for use of Confidential Data through Investigator responses to a series of questions, and records what the Investigator commits to do in order to keep Confidential Data secure.

K. "Deductive Disclosure" is the discerning of an individual's identity or confidential information through the use of known characteristics of that individual. Disclosure risk is present if an unacceptably narrow estimation of an individual's confidential information is possible or if determining the exact attributes of the individual is possible with a high level of confidence.

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III. REQUIREMENTS OF INVESTIGATORS

A. Investigators must meet the following criteria:

1. Have a PhD or other terminal degree; and
2. Hold a faculty appointment or research position at Institution.

B. The Investigator assumes the responsibility of completing the RDCS online application and required documents, reports, and amendments. The Investigator agrees to responsibly manage and use Confidential Data and implement all Confidentiality Data security procedures per the Data Security Plan.

C. The Investigator will provide ICPSR any publications or public presentations derived from the Confidential Data.

IV. REQUIREMENTS OF INSTITUTION

The Institution must meet the following criteria:

A. Be an institution of higher education, a research organization, a research arm of a government agency, or a nongovernmental, not for profit, agency.

B. Have a demonstrated record of using Confidential Data according to commonly accepted standards of research ethics and applicable statutory requirements.

V. OBLIGATIONS OF ICPSR

In consideration of the promises made in Section VI of this Agreement, ICPSR agrees to:

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B. Provide electronic documentation of the origins, form, and general content of the Confidential Data, in the same time period and manner as the Confidential Data.

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VI. OBLIGATIONS OF INVESTIGATOR, RESEARCH STAFF, AND INSTITUTION

Confidential Data provided under this Agreement shall be accessed by the Investigator, Research Staff, Participants, and Institution in strictest confidence and can be disclosed only in compliance with the terms of this Agreement. In consideration of the promises in Section V of this Agreement, and for use of Confidential Data from ICPSR, the Investigator, Research Staff, Participants, and Institution agree:

A. That the Confidential Data will be used solely for research or statistical purposes relative to the research project identified on the Application for Obtaining Confidential Data accompanying this Agreement, and for no other purpose whatsoever without the prior consent of ICPSR. Further, no attempt will be made to identify private persons, no Confidential Data of private person(s) will be published or otherwise distributed, and Confidential Data will be protected against deductive disclosure risk by strictly adhering to the obligations set forth in this Agreement and otherwise taking precautions to protect the Confidential Data from non-authorized use.

B. To supply ICPSR with a completed RDCS online Application for Obtaining Confidential Data that will include the following:

1. A signed Agreement
2. A Research Plan describing inquiry and publications consistent with the objectives of the Measuring Effective Teaching Project to advance knowledge about effective teachers and teaching.
3. Confidential Data Order Summary specifying which files and documentation are requested
4. A copy of a document signed by the Institution's Institutional Review Board (IRB) approving or exempting the research project

C. To comply fully with the approved Data Security Plan at all times relevant to this Agreement.

D. That no persons other than those identified in this Agreement or in subsequent amendments to this Agreement, as Investigator, Research Staff or Participant and who have executed this Agreement, be permitted access to the contents of Confidential Data files or any files derived from Confidential Data files.

E. To not disclose or otherwise make available to current and former employees of the Charlotte-Mecklenburg Schools, Dallas Independent School District, Denver Public Schools, Hillsborough County Public Schools, Memphis City Schools, and New York City Department of Education ("School Districts") any Confidential Data derived from the School District for which they are a current or former employee. Investigators, Research Staff, and Participants must disclose to ICPSR any current or past affiliations with the School Districts.

F. That within one (1) business day of becoming aware of any unauthorized access, use, or disclosure of Confidential Data, or access, use, or disclosure of Confidential Data that is inconsistent with the terms and conditions of this Agreement, the unauthorized or inconsistent access, use, or disclosure of Confidential Data will be reported in writing to ICPSR.

G. That, unless prior specific approval is received from ICPSR, no attempt under any circumstances will be made to link the Confidential Data to any individual, whether living or deceased, or with any other dataset, including other datasets provided by ICPSR.

H. To avoid inadvertent disclosure of private persons by being knowledgeable about what factors constitute disclosure risk and by using disclosure risk guidelines, such as but not limited to, the following guidelines in the release of statistics or other content derived from the Confidential Data.[1]

1. No release of a sample unique for which only one record in the Confidential Data obtained through sampling (e.g., not a census) provides a certain combination of values from key variables. For example, in no table should all cases in any row or column be found in a single cell.

2. No release of a sample rare for which only a small number of records (e.g., 3, 5, or 10 depending on sample characteristics) in the Confidential Data provide a certain combination of values from key variables. For example, in no instance should the cell frequency of a cross-tabulation, a total for a row or column of a cross-tabulation, or a quantity figure be fewer than the appropriate threshold as determined from the sample characteristics. In general, assess empty cells and full cells for disclosure risk stemming from sampled records of a defined group reporting the same characteristics.

3. No release of a population unique for which only one record in the Confidential Data that represents the entire population (e.g., from a census) provides a certain combination of values

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[1] For more information, see the U.S. Bureau of the Census checklist. *Supporting Document*

*Checklist on Disclosure Potential of Data, at www.**census**.gov/srd/sdc/S14-1_v1.3_**Checklist**.doc; NCHS Disclosure Potential Checklist* at http://www.cdc.gov/nchs/data/NCHS%20Micro-Data%20Release%20Policy%204-02A.pdf; and *FCSM Statistical Policy Working Paper 22 (Second Version, 2005)* at http://www.fcsm.gov/working-papers/SPWP22_rev.pdf.

from key variables. For example, in no table should all cases in any row or column be found in a single cell.

4. No release of the statistic if the total, mean, or average is based on fewer cases than the appropriate threshold as determined from the sample characteristics.

5. No release of the statistic if the contribution of a few observations dominates the estimate of a particular cell. For example, in no instance should the quantity figures be released if one case contributes more than 60 percent of the quantity amount.

6. No release of data that permits disclosure when used in combination with other known data. For example, unique values or counts below the appropriate threshold for key variables in the Confidential Data that are continuous and link to other data from ICPSR or elsewhere.

7. No release of minimum and maximum values of identifiable characteristics (e.g., income, age, household size, etc.) or reporting of values in the "tails," e.g., the 5^{th} or 95^{th} percentile, from a variable(s) representing highly skewed populations.

8. Release only weighted results if specified in the data documentation.

9. No release of ANOVAs and regression equations when the analytic model that includes categorical covariates is saturated or nearly saturated. In general, variables in analytic models should conform to disclosure rules for descriptive statistics (e.g., see #7 above) and appropriate weights should be applied.

10. In no instance should data on an identifiable case, or any of the kinds of data listed in preceding items 1-9, be derivable through subtraction or other calculation from the combination of tables released.

11. No release of sample population information or characteristics in greater detail than released or published by the researchers who collected the Confidential Data. This includes but is not limited to publication of maps.

12. No release of anecdotal information about a specific private person(s) or case study without prior approval.

13. The above guidelines also apply to charts as they are graphical representations of cross-tabulations. In addition, graphical outputs (e.g., scatterplots, box plots, plots of residuals) should adhere to the above guidelines.

I. To mitigate the risk of disclosing identities or private information derived from the Confidential Information by following practices that include, but are not limited to the following:

1. No streaming video from the Confidential Data may be captured on any computer or other medium.

2. No excerpts, images or other derivatives from the Confidential Data may be published or disseminated in any way.

3. No descriptions of individuals, activities, environments, or other aspects of the Confidential Data may be released in a way that would lead to identification of individuals. Information about

objects in the Confidential Data (such as school, grade, subject) may not be included in presentations or publications if they may increase the risk of disclosure. Special care should be used in describing attributes of individuals that in combination might uniquely identify an individual, such as school, grade, age, race, gender, "gifted," "special education," "English language learner," or physical attributes (height, weight, hair color, etc.).

4. No anecdotal descriptions or verbatim transcripts may be released if they can be linked to information that increases the risk of identification of individuals.

5. No information from quantitative and video objects in the Confidential Data may be linked for the purpose of identifying individuals.

6. No identifying information revealed by individuals depicted in the Confidential Data may be recorded in any way. For example, names of persons, places, or events written on blackboards or spoken by an individual may not be written on paper or typed into a computer document. This type of information may never be released in public presentations or publications. If there is any doubt about whether a research note may pose a disclosure risk, it should be created within the Virtual Data Enclave.

J. That if the identity of any private person should be discovered, then:

1. No use will be made of this knowledge;

2. ICPSR will be advised of the incident within five (5) business days of discovery of the incident;

3. The information that would identify the private person will be safeguarded or destroyed as requested by ICPSR; and

4. No one else will be informed of the discovered identity..

K. Unless other provisions have been made with ICPSR, all access to the Confidential Data will be terminated on or before completion of this Agreement or within five (5) days of written notice from ICPSR. Investigators requiring access to the Confidential Data beyond completion of this Agreement should submit a request for continuation three months prior to the end date of the Agreement.

L. To ensure that the Confidential Data are managed and used in compliance with the terms and conditions of this Agreement and with all applicable statutes and regulations. Noncompliance with this Agreement by any Research Staff or Participant hereto shall be deemed noncompliance and a breach by Investigator and Institution for purposes of section VII below.

M. To notify ICPSR of a change in institutional affiliation of the Investigator. Notification must be in writing and must be received by ICPSR at least six (6) weeks prior to Investigator's last day of employment with Institution. Investigator's separation from Institution terminates this Agreement. Investigator may reapply for access to Confidential Data as an employee of the new institution. Re-application requires:

1. Execution of a new Agreement for the Use of Confidential Data by both the Investigator and the proposed new institution;

2. Execution of any Supplemental Agreement(s) with Research Staff and Pledges of Confidentiality by Research Staff and Participants at the proposed new institution;

3. Preparation and approval of a new Data Security Plan; and

4. Evidence of approval or exemption by the proposed new institution's IRB.

These materials must be approved by ICPSR before Confidential Data or any derivatives or analyses may be accessed at the new institution.

N. That if the Investigator who is changing institutions does not have the new agreement executed by the time they leave their institution, ICPSR will temporarily deactivate the Investigator's account but will maintain the Investigator's profile to save their work during the transition. Upon approval of the new RDCS online application, ICPSR will reactivate the Investigator's account. If a new agreement is not executed within three (3) month, the Investigator's account will be deleted.

O. That any books, articles, conference papers, theses, dissertations, reports, or other publications that employed the Confidential Data or other resources provided by ICPSR reference the bibliographic citation provided by ICPSR in the study description.

P. That use of the Confidential Data will be consistent with the Institution's policies regarding scientific integrity and human subjects research.

Q. To respond fully and in writing within ten (10) working days after receipt of any written inquiry from ICPSR regarding compliance with this Agreement.

VII. VIOLATIONS OF THIS AGREEMENT

A. The Institution will treat allegations by ICPSR or other parties of violations of this Agreement as allegations of violations of its policies and procedures on scientific integrity and misconduct. If the allegations are confirmed, the Institution will treat the violations as it would violations of the explicit terms of its policies on scientific integrity and misconduct.

B. In the event Investigator or Institution breaches any provision of this Agreement, they shall be jointly and severally responsible to promptly cure the breach and mitigate any damages. Investigator and Institution hereby acknowledge that any breach of the confidentiality provisions herein may result in irreparable harm to ICPSR not adequately compensable by money damages. Investigator and Institution hereby acknowledge the possibility of injunctive relief in the event of breach, in addition to money damages. In addition, ICPSR may:

1. Terminate this Agreement upon notice and terminate access to the Confidential Data and any derivatives thereof;

2. Deny Investigator future access to Confidential Data; and/or

3. Report the inappropriate use or disclosure to the appropriate federal and private agencies or foundations that fund scientific and public policy research.

C. Institution agrees, to the extent permitted under the law, to indemnify, defend, and hold harmless The University of Michigan, ICPSR, RAND Corporation, Bill & Melinda Gates Foundation, and the sources of Confidential Data from any or all claims and losses accruing to any person, organization, or other legal entity as a result of Investigator's, Research Staff's, Participant's, and/or Institution's acts, omissions, or breaches of this Agreement.

VIII. CONFIDENTIALITY

The Institution is considered to be a contractor or cooperating agency of ICPSR; as such, the Institution, the Investigator, and Research Staff are authorized to protect the privacy of the individuals who are the subjects of the Confidential Data by withholding their identifying characteristics from all persons not connected with the conduct of the Investigator's research project. Identifying characteristics are considered to include those data defined as confidential under the terms of this Agreement.

IX. INCORPORATION BY REFERENCE

All parties agree that the following documents are incorporated into this Agreement by reference:

A. The Application for Obtaining Confidential Data

B. A copy of the Institution's IRB approval or exemption of the Research Project

C. The Data Security Plan proposed by the Investigator and approved by ICPSR

X. MISCELLANEOUS

A. All notices, contractual correspondence, and return of data under this Agreement on behalf of the Investigator shall be made in writing and delivered to the address below:

MET Longitudinal Database Restricted Data Manager
ICPSR
P.O. Box 1248
Ann Arbor, MI 48106-1248

B. This agreement shall be effective for 24 months from execution.

C. The respective rights and obligations of ICPSR and Investigator, Research Staff, and Institution pursuant to this Agreement shall survive termination of the Agreement.

D. This Agreement may be amended or modified only by the mutual written consent of the authorized representatives of ICPSR and Investigator and Institution. Investigator's research project, Data Security Plan, Research Staff, or Participants may be amended or modified only by submitting such amendments or modifications to the RDCS and receiving approval from the authorized representatives of ICPSR. This Agreement may be extended only by submitting an extension request to the RDCS and receiving approval from the authorized representatives of ICPSR. Investigator and Institution agree to amend this Agreement to the extent necessary for ICPSR to comply with the requirements of any applicable regulatory authority.

E. The persons signing this Agreement have the right and authority to execute this Agreement, and no further approvals are necessary to create a binding agreement.

F. The obligations of Investigator, Research Staff, Participants, and Institution set forth within this Agreement may not be assigned or otherwise transferred without the express written consent of ICPSR.

Investigator and Institutional Signatures

Investigator	Institutional Representative
SIGNATURE DATE	SIGNATURE DATE
NAME TYPED OR PRINTED	NAME TYPED OR PRINTED
TITLE	TITLE
INSTITUTION	INSTITUTION
BUILDING ADDRESS	BUILDING ADDRESS
STREET ADDRESS	STREET ADDRESS
CITY, STATE, ZIP	CITY, STATE, ZIP

Representative of The Regents of
the University of Michigan

SIGNATURE DATE

PRINTED NAME AND TITLE

Attachment A: Data Security Plan

All of the following computer and data security requirements and procedures are required to be implemented as part of this Agreement:

- You must password protect the computer that is used to access the MET Longitudinal Database.
- Under no circumstances may you share or give your MET Longitudinal Database username and password to anyone, and this includes not sharing them with other members of your project team or your organization's IT staff. Passwords must not be stored on a computer in electronic or written form. Software password storage programs may not be used.
- Since the MET Longitudinal Database is administered by ICPSR, University of Michigan you should not contact the IT staff at your organization with questions about the MET Longitudinal Database. (You may contact your organization's IT staff if you need help installing the VM client software to access the MET Longitudinal Database. Your organization's IT staff should never be allowed to access the MET Longitudinal Database or any Confidential Data.)
- Under no circumstances can any unauthorized person be allowed to access or view Confidential Data within the MET Longitudinal Database.
- Unauthorized persons are not allowed to be inside the Secure Project Office when an authorized project team member is logged into the MET Longitudinal Database.
- You must not allow the computer monitor to display MET Longitudinal Database content to any unauthorized person. The computer monitor display screen must not be visible from open doors or through windows.
- You must set the computer to activate a password protected screen saver after three minutes of inactivity.
- If you are logged into the MET Longitudinal Database and you leave your computer, you must "disconnect" or "logoff" from the MET Longitudinal Database. (Disconnecting from the MET Longitudinal Database will leave any open programs running, but closes the connection to the MET Longitudinal Database. Logging off of the MET Longitudinal Database closes the connection and terminates all programs that are running.)
- All Confidential Data must be kept within the MET Longitudinal Database:
    - You must not duplicate or copy the data (e.g., you must not retype and/or use non-technical ways of copying the data, such as handwritten notes).
    - You must not take screenshots, photographs, or videos of the displayed Confidential Data or statistical outputs.
    - You must not type or record the Confidential Data or results from the data onto your PC or onto some other device or media.
- You must protect all hardcopy documents related to the Confidential Data such as research notes. Such hardcopy documents must be kept in locked drawers or cabinets when not in use.
- Prior to a disclosure review and approval by ICPSR, neither you nor any project team member may talk about or discuss any Confidential Data or results from the MET Longitudinal Database in non-secure or public locations. These discussions cannot occur where an unauthorized person could eavesdrop.
- You must submit all statistical outputs/results from the MET Longitudinal Database to ICPSR for a disclosure review prior to sharing or giving such outputs to unauthorized persons. You also agree to revise or alter such outputs as required by ICPSR in order to

minimize disclosure risk prior to ICPSR approving these outputs for dissemination to unauthorized persons.

- You may only disseminate aggregated information from the Confidential Data to unauthorized persons after you obtain clearance to do so through the ICPSR disclosure review process.
- Each member of your research team included in this application must only use the data on a computer in a Secure Project Office.
- When the data are being used:
  - the screen must not be visible from the doorway or windows
  - the door must be closed
  - only individuals approved to work with these data may be in the room.

When the data are active but the individual is out of the office, the office door must be locked.

VITA

CORINA BULLOCK

Education

June 2010 – Present (Expected graduation date August 2018)
Enrolled in Educational Leadership Doctoral Program at Sam Houston State University, Huntsville, TX

December 1999
Master of Education in Educational Administration**,** Prairie View A&M University, Prairie View, TX

May 1979
Bachelor of Science in Mechanical Engineering**,** Prairie View A&M University, Prairie View, TX

Academic Employment

August 2017 – Present
Teacher, Kashmere Gardens Elementary, Houston Independent School District, Houston, TX

- Currently teaching all core content in the areas of reading, writing, mathematics, science, and social studies to 22 fourth-grade students (68% African American students and 32% Hispanic students).
- Monitor students' academic progress and provide individualized instruction to meet students' needs.
- Communicate with administrators and parents about students' progress and assigned interventions.

August 2011 – August 2017
Resource Teacher-Chairperson, S. C. Red Elementary, Houston Independent School District, Houston, TX

- Acted as liaison between administrators and faculty/staff to facilitate educational programming for over 60 students with disabilities involving specific learning disabilities, autism, and intellectual disabilities in various classroom settings.
- Coordinated and conduct campus Annual Review Dismissal (ARD)/Individualized Education Plan (IEP) committee meetings and monitor the implementation of ARD/IEP decisions, transitions, and instructional testing with administrators, teachers, district staff, parents, and students.
- Monitored campus case management of students.
- Provided information to parents and other persons regarding special education services and curriculum.
- Arranged and conduct in-services related to the education and service for students with disabilities.
- Worked with general education teachers and campus leaders to identify curriculum needs and suggest ways to update and modify curriculum design, strategies and materials.

- Designed and implemented instruction that positively influence students' self-esteem and academic achievement for first through fifth grade students with specific learning disabilities and other health impairments.

August 2005 – June 2011
Academic Trainer, Professional Development Services, Houston Independent School District, Houston, TX

- Served as the district coordinator and contact person for the All Kinds of Minds initiative to assist both district and out of district educators in applying findings from neuroscience research to instructional practices for the academic success of diverse learners.
- Provided specialized trainings including the Dyslexia Intervention Program and Creating Independence through Student-owned Strategies (CRISS) to K-12 teachers.
- Coordinated and implemented the Exponential Achievement Project (REAP) Conference for the district's K-12 teachers, focusing on researched best practices for working with students in poverty 2007-2008.
- Served as a department representative to collaborate and develop curriculum modules with other central and regional offices staff members for the district's annual summer leadership institute for school administrative teams.
- Developed and presented instructional modules incorporating technology for elementary teachers in the content areas of reading, writing, and mathematics using SMART Board Interactive White Board and Web 2.0 Tools.
- Provided training and coaching in reading and mathematics for K-6th teachers.
- Mentored first and second year teachers by providing them support in and out of the classroom environment.
- Facilitated book studies for school administrators and teachers.

August 2003 – June 2005
Teacher, Louisa May Alcott Elementary, Houston Independent School District, Houston, TX

- Served as the school's Language Arts Lead Teacher collaborating with Language Arts team to develop department budget and devise school improvement plan for increasing the number of students passing state and local tests.
- Provided writing instruction to all fourth-grade students (65% African American and 35% Hispanic), which resulted in 97% of the students passing the Texas Assessment of Knowledge and Skills (TAKS) Writing Test successfully.
- Served as the Fourth-Grade English Language Learners classroom teacher teaching core subjects areas.
- Developed and demonstrated fun writing workshops for teachers and parents to model how to engage students in meaningful writing projects using various items in students' environment.
- Spearheaded both Reading and Writing Family Nights, resulting in the participation of more than 50 families per night.
- Worked with the Houston Area Urban League to serve as the school's National Achievers Society sponsor to 50 Grades 3-5 African American and Hispanic students striving for excellence.

August 2002 – June 2003
Teacher, Juan Seguin Elementary, Houston Independent School District, Houston, TX

- Served as grade level chairperson.
- Taught Fourth/Fifth Grade English as Second Language (ESL) in core subject areas in which 95% of students were exited from the Limited English Proficiency Program.

August 1993 – June 2002
Teacher, Charlotte B. Allen Elementary, Houston Independent School District, Houston, TX

- Taught core content in the areas of reading, writing, and mathematics to 31 fifth-grade students (95% African American and 5% Hispanic), which resulted in an average gain of 2-years growth on Stanford 9 Achievement Test and 96% passing rate on the TAAS on the reading and mathematics sub-tests.
- Developed and conducted numerous math workshops to demonstrate problem solving strategies and effective use of manipulatives as the school’s Math Lead Teacher.
- Served as both the grade chairperson and the vertical team leader in providing guidance to peers in implementing the district’s curriculum in the core content areas.
- Coordinated the school's annual Parent Appreciation celebration and workshops to assist parents in helping their children with various objectives in reading, writing, and math.
- Developed and spearheaded the campus-wide Academic Scouts Program in which students from K-5th Grades earned academic honor patches for mastering skills in reading, writing, and math.
- Taught regular and gifted students in Grades 1-5 in a self-contained classroom.
- Participated in grade progression with students from first – fifth grade with positive outcomes.

August 1986 – June 1993
Teacher, Luther Burbank Elementary, Houston Independent School District, Houston, TX

- Served as grade level chairperson for 5th Grade coordinating instructional plans and field studies to provide students with real world experiences.
- Taught Grades 4-5 in all core subject areas.

Certification

- Superintendent (Early Childhood – Grade 12)
- Principal (Early Childhood-Grade 12)
- Elementary Self Contained (Grades PK-8)
- Generic Special Education (Grades PK-12)
- English as a Second Language (Grades PK-12)

Administrative Certifications

- Instructional Leadership Development
- Professional Development Appraisal System

Publications

- Wilson, J. L. Berkowitz, S., Bullock, C., Rodriguez L. M., & Onwuegbuzie, A. J. (2012). Online instructional materials for students with disabilities: Does it work? *International Journal of Education*, 4(3), 12-30. doi:10.5296/ije.v4i2.1604

Presentations at Professional Meetings

- Bullock, C. The relationship between African American boys' attitudes of their teacher-student relationships and their mathematics achievement on state tests. The 31st Annual Meeting of Texas Alliance of Black School Educators, Frisco, Texas, 4 March 2016.
- Bullock, C. Longitudinal study on the relationship between African American boys' attitudes of their teacher-student relationships and their mathematics achievement on state tests. The 39th Annual Meeting of Southwest Educational Research Association (SERA) Conference, New Orleans, Louisiana, 11 February 2016.
- Bullock, C. Maximizing learning for students using powerful and proven instructional strategies. Annual Conference of National Association of Black School Educators, Kansas City, Missouri, 22 November 2014.
- Wilson, J. L. Berkowitz, S., Bullock, C., Rodriguez L. M. Online instructional materials for students with disabilities: Does it work? The 35th Annual Meeting of Southwest Educational Research Association (SERA) Conference, New Orleans, Louisiana 10 February 2012.
- Bullock, C. and Yates, C. Math without walls: learning beyond boundaries. Annual Conference of Association for Supervisors and Curriculum Development, Orlando, Florida, 15 March, 2009.
- Bullock, C., Green-Hampton, A., Prestwood, G., McAffie, D., Baker, I., and Davis. L. Instructional techniques that impact the academic achievement of minority students. Annual Conference of National Staff Development Council, Dallas, Texas, 5 December 2007.
- Bullock, C. Changing the attitudes of minority students toward math. Annual Conference of National Council of Teachers of Mathematics, Atlanta, Georgia, 24 March 2007.

Academic Awards

- Northern Life’s Unsung Hero Award 1996
- Allen Elementary Teacher of the Year 1995-1996
- Allen Elementary’s HAABSE Teacher of the Year, 1995 and 2002
- HAABSE Teacher of the Year, First Runner-up, 2002

Professional Memberships

- Association for Supervision and Curriculum Development (ASCD)
- Houston Area Alliance of Black School Educators (HAABSE)
    - Recording Secretary
    - Co-Leader of Professional Development
- National Alliance of Black School Educators (NABSE)
- National Council of Teachers of Mathematics (NCTM)
- Texas Alliance of Black School Educators (TABSE)