

Preparing and Supporting Black Students to Enroll and Achieve in Advanced  
Mathematics Classes in Middle School: A Case Study

Joyce Bernice Cobbs

Dissertation submitted to the faculty of the Virginia Polytechnic Institute and State  
University in partial fulfillment of the requirements for the degree of  
Doctor of Education  
In  
Educational Leadership and Policy Studies

William J. Glenn, Chair

Asia R. Jones

Valija C. Rose

James L. Sellers

December 3, 2014

Blacksburg, Virginia

Key words: factors, mathematics, middle school, minorities, underrepresentation

Preparing and Supporting Black Students to Enroll and Achieve in Advanced Mathematics  
Classes in Middle School: A Case Study

Joyce Bernice Cobbs

**ABSTRACT**

The literature on minority student achievement indicates that Black students are underrepresented in advanced mathematics courses. Advanced mathematics courses offer students the opportunity to engage with challenging curricula, experience rigorous instruction, and interact with quality teachers. The middle school years are particularly significant for mathematics education since the courses students pursue during those years affect later access to rigorous mathematics coursework at the high school level as well as college and career readiness.

This case study examined factors that affected Black student achievement in advanced mathematics classes at one middle school. Data included interviews of school personnel, on-site observations, and school-related document analysis. Six major themes that affected student achievement in advanced mathematics classes emerged from the data: (a) mathematics placement innovations, (b) cultural shift towards increased rigor, (c) culture of high expectations, (d) culture of continuous learning, (e) data sharing, and (f) perceived barriers to enrollment. The conceptual framework of Bryk, Sebring, Allensworth, Luppescu, and Easton (2010) was used to identify and explain the relationships among these categories. This case study highlighted key district and school individuals who initiated and implemented the wave of changes regarding mathematics placement and teaching that occurred over a four-year period. The study also identified barriers that seemed to impede Black student enrollment in such classes. The findings illustrated how concerted efforts provided students with a challenging curriculum, thus, increasing access to advanced mathematics classes for all students. Policies and practices that lifted all students had a positive effect for Black students.

## ACKNOWLEDGEMENTS

*For nothing is impossible with God.* (Luke 1:37). Earning a doctoral degree is not an individual effort but the persistent and determined efforts of many individuals. First and foremost, I would like to thank God for His works in me so that I could endure the journey knowing that *all things are possible with Him*. As the work unfolded, He opened doors to people and resources at the right moments so I could finish my dissertation. Dr. Glenn, thank you, for believing in me, for your patience, and for your guidance and support. Thank you for the countless hours helping me to develop my research skills and complete this study. I would also like to thank my other committee members, Dr. Valija Rose, Dr. Asia Jones, and Dr. James Sellers, for helping me to deepen my background in educational leadership. You were more than generous with your expertise and time. Dr. Rose, thank you for spending additional time reading and providing feedback.

Thank you to Rose District, the Superintendent, and Rose Middle School for allowing me to use one of your schools as a study site. A special thank you goes out to the Principal and study participants who took the time to share their experiences with me so that I could complete this study.

There is something to be said about the power of encouragement. Thank you Dana Kelley for the continuous encouragement and *push* along the way so I could complete this process. I know that God put us on the same path for just a few minutes because He knew that I would need you to help me when I felt like giving up. I would also like to express my gratitude to several of my colleagues and friends who supported and encouraged me to complete this process. Joyce, Susan, Brenda, Dorrie, and Kathy, thank you for encouraging, reading, and providing important feedback during the journey. I would also like to acknowledge and thank my children (Kim, Bradley, and Jennifer) and my family for your encouragement and prayers. Thank you to my middle school family who encouraged and supported this endeavor.

Finally, there is something to be said about the power of prayer. I would like to thank my husband, Hildred L. Cobbs, for encouraging me to start the program and for being my prayer partner and remaining my friend and confidant during the journey. I need for you to know this degree is our joint efforts. It is because of you that Kim, Bradley and I have degrees and we are most appreciative of your sacrifices and beliefs in the power of an education and in the power of prayer. To quote Dr. King, “[You] *have the audacity to believe that people everywhere can have*

*three meals a day for their bodies, education and culture for their minds, and dignity, equality, and freedom for their spirits.* Therefore, this degree is dedicated to my husband and the many individuals who labored in the fields of injustices so that I might have a right to have obtained such a degree.

## TABLE OF CONTENTS

<b>ACKNOWLEDGEMENTS .....</b>	<b>III</b>
<b>LIST OF TABLES .....</b>	<b>X</b>
<b>LIST OF FIGURES .....</b>	<b>XI</b>
<b>CHAPTER 1 A SYNOPSIS OF THE PROBLEM AND CONTEXT FOR THE STUDY.....</b>	<b>1</b>
STATEMENT OF THE PROBLEM.....	2
BACKGROUND AND CONTEXT FOR THE PROBLEM .....	3
CONCEPTUAL FRAMEWORK .....	4
PURPOSE OF THE STUDY.....	6
RESEARCH QUESTIONS.....	6
SIGNIFICANCE OF THE STUDY.....	7
OVERVIEW OF THE METHODOLOGY.....	8
ASSUMPTIONS, LIMITATIONS, AND DELIMITATIONS .....	8
DEFINITIONS OF KEY TERMS.....	9
ORGANIZATION OF THE STUDY.....	11
<b>CHAPTER 2 REVIEW OF THE LITERATURE .....</b>	<b>12</b>
BACKGROUND.....	12
PURPOSE OF THE LITERATURE REVIEW .....	12
IMPORTANCE OF ADVANCED MATHEMATICS CLASSES.....	13
IMPORTANCE OF ADVANCED MATHEMATICS CLASSES FOR MINORITY STUDENTS .....	14
MINORITY REPRESENTATION IN ADVANCED MATHEMATICS COURSES .....	17
ROLE OF SCHOOLS IN INCREASING MINORITY STUDENTS’ ACCESS TO ADVANCED COURSES.....	29
SUMMARY.....	37
<b>CHAPTER 3 RESEARCH METHODOLOGY .....</b>	<b>38</b>
PURPOSE OF THE STUDY.....	38
RESEARCH QUESTIONS.....	39
THE CASE STUDY DESIGN.....	39
RATIONALE FOR CASE STUDY DESIGN .....	40
DESCRIPTION AND INTERPRETATION .....	40
RESEARCH SETTING AND PARTICIPANTS .....	41

PARTICIPANTS.....	46
DATA COLLECTION PROCEDURES .....	47
INTERVIEWS .....	48
OBSERVATIONS .....	52
DOCUMENTS AND OTHER ARTIFACTS .....	52
DATA MANAGEMENT PROCEDURES .....	53
DATA ANALYSIS PROCEDURES.....	53
CONSTANT COMPARATIVE ANALYSIS .....	54
INTERVIEW DATA.....	54
OBSERVATIONS, DOCUMENTS, AND OTHER ARTIFACTS .....	56
ENSURING THE QUALITY OF THE RESEARCH.....	56
ETHICAL CONSIDERATIONS .....	56
THE ROLE OF THE RESEARCHER AND MANAGING POSSIBLE BIAS .....	57
TRUSTWORTHINESS OF THE STUDY .....	58
SUMMARY.....	60
<b>CHAPTER 4 FINDINGS.....</b>	<b>61</b>
MATHEMATICS PLACEMENT INNOVATIONS.....	64
CULTURAL SHIFT TOWARDS INCREASED RIGOR .....	77
CULTURE OF HIGH EXPECTATIONS.....	81
CULTURE OF CONTINUOUS LEARNING.....	86
DATA SHARING .....	93
PERCEIVED BARRIERS TO ENROLLMENT.....	95
SUMMARY OF THE FINDINGS .....	101
<b>CHAPTER 5 DISCUSSION, LIMITATIONS, IMPLICATIONS, RECOMMENDATIONS, AND CONCLUSION.....</b>	<b>103</b>
DISCUSSION OF FINDINGS.....	103
<i>Mathematics Placement Innovations.....</i>	<i>103</i>
<i>Cultural Shift towards Increased Rigor .....</i>	<i>109</i>
<i>Culture of High Expectations .....</i>	<i>113</i>
<i>Culture of Continuous Learning.....</i>	<i>116</i>
<i>Data Sharing .....</i>	<i>120</i>

<i>Perceived Barriers to Enrollment</i> .....	121
IMPLICATIONS AND RECOMMENDATIONS .....	128
<i>Communication</i> .....	128
<i>Early Assessment</i> .....	129
<i>Explicit Discussion of Cultural Beliefs</i> .....	129
<i>Academic Advising</i> .....	130
<i>High Expectations</i> .....	130
RECOMMENDATIONS FOR FUTURE RESEARCH .....	130
CONCLUSION.....	131
<b>REFERENCES</b> .....	<b>134</b>

<b>APPENDIX A INITIAL PHONE CONTACT TO SUPERINTENDENT, PRINCIPAL, OR ASSISTANT PRINCIPAL REQUESTING PERMISSION TO CONDUCT THE STUDY ....</b>	<b>151</b>
<b>APPENDIX B DISSERTATION PROPOSAL INFORMATION.....</b>	<b>152</b>
<b>APPENDIX C THANK YOU LETTER TO SUPERINTENDENT WHO AGREES TO ALLOW ACCESS TO THE DIVISION.....</b>	<b>154</b>
<b>APPENDIX D VIRGINIA TECH INFORMED CONSENT FOR PARTICIPANTS IN RESEARCH PROJECTS INVOLVING HUMAN SUBJECTS .....</b>	<b>155</b>
<b>APPENDIX E FORM FOR LISTING NAMES OF POSSIBLE PARTICIPANTS.....</b>	<b>159</b>
<b>APPENDIX F CRITERIA FOR SELECTING POSSIBLE STUDY PARTICIPANTS.....</b>	<b>160</b>
<b>APPENDIX G PHONE CALL SCRIPT FOR TEACHER PARTICIPANTS IN QUALITATIVE STUDY.....</b>	<b>162</b>
<b>APPENDIX H PHONE CALL SCRIPT FOR GUIDANCE COUNSELOR PARTICIPANTS IN QUALITATIVE STUDY .....</b>	<b>163</b>
<b>APPENDIX I THANK YOU AND CONFIRMATION EMAIL TO STUDY PARTICIPANTS .....</b>	<b>164</b>
<b>APPENDIX J OBSERVATION PROTOCOL.....</b>	<b>165</b>
<b>APPENDIX K MEETING/INTERVIEW PROTOCOL: PRINCIPAL, ASSISTANT PRINCIPAL, INSTRUCTIONAL COACH, TEACHERS, GUIDANCE COUNSELORS, AND DIRECTOR OF INSTRUCTION .....</b>	<b>166</b>
<b>APPENDIX L INTERVIEW PROTOCOL SCRIPT FOR PRINCIPAL, ASSISTANT PRINCIPAL, TEACHER, DEPARTMENT CHAIR, AND GUIDANCE COUNSELORS STUDY PARTICIPANTS .....</b>	<b>167</b>
<b>APPENDIX M CASE STUDY INTERVIEW QUESTIONS FOR ADMINISTRATION .....</b>	<b>169</b>
<b>APPENDIX N CASE STUDY INTERVIEW QUESTIONS FOR TEACHERS .....</b>	<b>171</b>
<b>APPENDIX O CASE STUDY INTERVIEW QUESTIONS FOR GUIDANCE COUNSELORS .....</b>	<b>173</b>
<b>APPENDIX P SCHOOL-RELATED DOCUMENTS OF INTEREST .....</b>	<b>175</b>
<b>APPENDIX Q CONTENT VALIDATION INSTRUMENT .....</b>	<b>176</b>

**APPENDIX R COVER LETTER FOR PARTICIPANTS – CONTENT VALIDITY CHECK**  
.....186

**APPENDIX S FRAMEWORK: RELATIONSHIP OF INTERVIEW QUESTIONS TO  
RESEARCH QUESTIONS** .....187

**LIST OF TABLES**

**TABLE 1 *PRE-ESTABLISHED CRITERIA FOR THE STUDY* .....43**

**TABLE 2 ROSE MIDDLE SCHOOL COURSE OFFERINGS 2013-2014.....45**

**TABLE 3 *DATA SOURCES FOR THE STUDY*.....48**

**TABLE 4 *CATEGORIES AND ATTENDANT THEMES* .....63**

**TABLE 5 2010-2014 CHANGES IN ENROLLMENT CRITERIA IN GRADE 6.....68**

**TABLE 6 2011-2014 CHANGES IN ENROLLMENT CRITERIA IN GRADE 7.....69**

**TABLE 7 2012-2014 CHANGES IN ENROLLMENT CRITERIA IN GRADE 8.....70**

**TABLE 8 *INSTRUCTIONAL STRATEGIES AND PRACTICES* .....92**

**LIST OF FIGURES**

***FIGURE 1. A FRAMEWORK FOR ESSENTIAL SUPPORTS. REPRODUCED FROM ORGANIZING SCHOOLS FOR IMPROVEMENT: LESSONS FROM CHICAGO (BRYK ET AL., 2010, PP. 232-238).....4***

***FIGURE 2. HONORS MATH RATING SCALE (RUBRIC).....71***

***FIGURE 3. TEACHER RECOMMENDATION FORM FOR HONORS MATH 6.....72***

***FIGURE 4. SAMPLE PERFORMANCE TASK. ....82***

***FIGURE 5. SAMPLE PROBLEM OF THE WEEK SAMPLE, AS DESCRIBED BY ONE STUDY PARTICIPANT, WAS AN EXTENSION OF THE PERFORMANCE TASK (SEE FIGURE 4), WHICH PROVIDED THOSE STUDENTS IN HONORS MATH WITH A MORE CHALLENGING WEEKLY TASK.....83***

## Chapter 1

### A Synopsis of the Problem and Context for the Study

In today's society education is central to an individual's quality of life and strongly influences how he or she takes advantage of opportunities such as college/post high school training, participates in the job market, and becomes a productive citizen. Therefore, a good education not only benefits the individual, but also society as a whole. A good education also helps individuals to think critically so they are better equipped to make sense of the ever-changing world.

One challenge is that many Black students are underrepresented in advanced courses that provide access to a challenging curriculum which supports college and career readiness. This underrepresentation is very concerning since the National Center for Children in Poverty [NCCP], (Robbins et al., 2012) reported that 65% of Black children under the age of 18 live in poverty. Educational attainment has been shown to reduce the negative impacts of poverty such as malnutrition, high mobility, and risk of academic difficulties (Kusiak, 2014). Some researchers suggest that a direct relationship exists between educational attainment and future job opportunities (Smith, 2008). Therefore, preparing Black students to problem-solve and think critically impacts greatly on their future and quality of life. Black children need to have exposure to a challenging curriculum and rigorous instruction so that they can have access to learning opportunities that will eventually support college and career readiness.

Various factors at school, home, and personal levels support or hinder access to challenging classes. Many of these outside factors are not under the control of the school. However, educators do have control over various factors inside the school which can contribute to children's opportunities to enroll and be successful in advanced level mathematics courses. Understanding how schools can best help students succeed in mathematics remains a challenge for educators (Brosnan, Schmidlin, & Grant, 2013). It is my hope that the results of this study will serve as a vehicle for improving mathematics achievement.

This study examined how one middle school implemented strategies, practices, and policies to prepare and support Black student enrollment and achievement in advanced mathematics classes. The study also identified barriers that may impede students' access to advanced mathematics courses and continue to foster the mathematics achievement gap and underrepresentation of Black students in such classes. This chapter includes an overview of the

problem, purpose and significance of the study, research questions, assumptions, limitations, delimitations, and definitions of key terms. The chapter concludes with a preview of the following chapters.

### **Statement of the Problem**

Research indicates that Black students are underrepresented in honors and advanced mathematics classes when compared to their White peers (Walker, 2007). This achievement gap in mathematics education is a growing concern among researchers and educators (Adelman, 2006; Boykin & Noguera, 2011; Darling-Hammond, 2004; Geiser & Santelices, 2004; National Council of Teachers of Mathematics [NCTM], 2008; Walker, 2007). Closing the achievement gap has been a focus of education reform in the United States since the Coleman et al., (1966) study, yet the achievement gap remains.

The middle school years are particularly important years for mathematics education (Walker, 2006). The mathematics curriculum that students pursue in middle school affects their educational placement in high school, choice of available courses, experience of academic intensity, exposure to quality of instruction, and even ability to graduate (Adelman, 2006, 2007; Darity, Castellino, Tyson, Cobb, & McMillen, 2001; Darling-Hammond, 2004; Ladson-Billings, 1997; Li & Hasan, 2010). Students who pursue a challenging mathematics curriculum in middle school start on a path to pursue Advanced Placement options in high school, which can afford these students more opportunities for college education and for advancement in the workforce (Adelman, 2006, 2007; Virginia Department of Education [VDOE], 2010).

While individuals need strong mathematical skills for technological advancements, STEM research, medical specialists, government agencies, and the educational field (Zuckerman, 2011), there is a concern that students, particularly Black students, are not accessing advanced level mathematics coursework, which can affect later high school, college, and workplace opportunities (Walker, 2006). Therefore, the achievement gap in mathematics affects individual students and the workforce as a whole. Zuckerman (2011) noted that schools need a rigorous mathematics curriculum that prepares all students for 21<sup>st</sup> century careers.

## Background and Context for the Problem

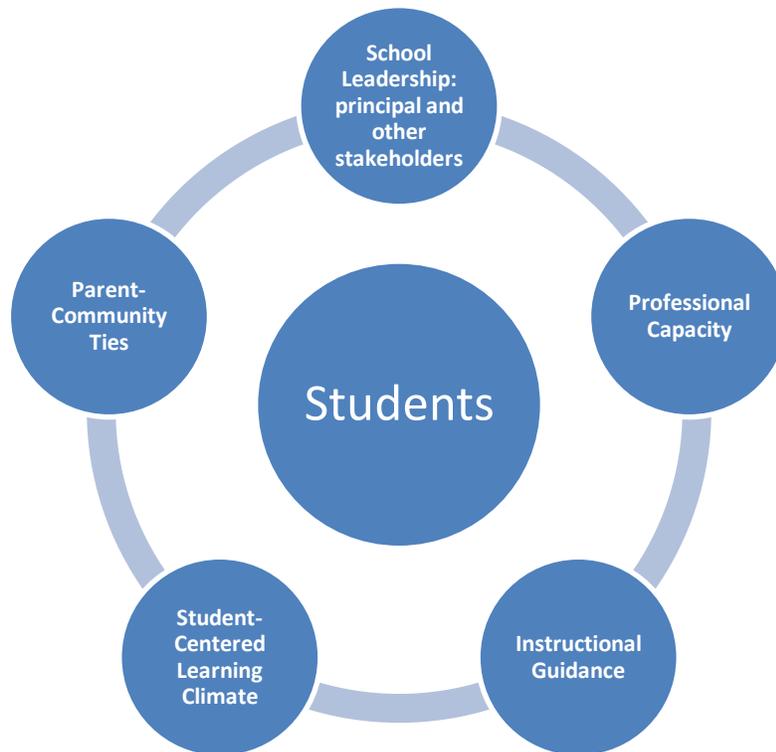
Prior to the Civil Rights Movement, the nation experienced considerable student achievement disparity between Black and White students in public schools because “[p]olicy measures that focused on rights, resources, and required testing for students [did] not achieved their promise to narrow the achievement gap” (Ferguson & Mehta, 2004, p. 656). The “separate but equal” policies of the time ignored the equality requirement, so Black students had limited access to equitable facilities, resources, quality teachers, and curriculum (Darling-Hammond, 2004). In the 1950s and 1960s, civil rights leaders declared literacy and numeracy to be the key to citizenship (Morris, 1984, as cited in Ladson-Billings, 1997). Thereafter, certain federal programs, such as Project Head Start and Title I programs, were implemented to give children living in poverty a chance for success (Jensen, 2009). One of the goals of President Lyndon B. Johnson’s *War on Poverty* initiative was to “ensure that all children have a fair, equal, and significant opportunity to obtain a high-quality education” (*No Child Left Behind*, 2002, p. 3).

Today, under the provisions of the *No Child Left Behind Act* (2002), states and public school districts are expected to (1) establish rigorous mathematics and reading standards that outline the expected levels of achievement for all students, (2) hire highly qualified teachers and paraprofessionals, and (3) provide students access to these rigorous standards in a safe and orderly environment. Along with these standards, the federal government expected that states would create mathematics and reading assessments that aligned and measured student achievement growth. These standards targeted Grades 3-12, with heavy emphasis on the following subgroups: students with disabilities (SWD), English Language Student Learners (ESL), students eligible for free and reduced lunch, and minority students. Standards-based reading and mathematics reform has caused states to reevaluate not only the academic progress of all students but also students within these specific subgroups.

Even though the Civil Rights Movement fought for the basic rights of individuals, especially minorities and poor Whites, educational disparities continue. Although educational programs, initiatives, and laws were implemented, Walker (2007) has asserted that “mathematics classrooms are one of the most segregated places in America” (p. 1). The following section provides a framework that was used in this study, along with information from the literature review, to help identify key practices and strategies that supported mathematics achievement.

## Conceptual Framework

Roberts (2010) stated that “a conceptual framework identifies the key factors, constructs, or variables which help to provide clarity for the direction a study will take” (p. 129). Since this study will examine the key strategies, policies, and practices that a middle school used to support advanced mathematics achievement, the conceptual framework focused on identifying and explaining the relationships among key variables that shape mathematics achievement within schools. Bryk, Sebring, Allensworth, Luppescu, and Easton (2010) from the Consortium on Chicago Schools Research (CCSR) introduced a framework entitled “the five essential supports for school improvement,” which included (a) providing strong school leadership, (b) building the professional capacity of the teaching staff, (c) providing instructional guidance, (d) improving the school learning climate, and (e) establishing partnerships with parents and the extended community. A graphic representation of this framework appears in Figure 1.



*Figure 1.* A framework for essential supports. Reproduced from *Organizing Schools for Improvement: Lessons from Chicago* (Bryk et al., 2010, pp. 232-238).

Bryk et al. (2010) argued that these essential supports explained why some schools in Chicago showed vast improvements in reading and mathematics achievement during the span of their study from 1997-2005. The researchers found that certain schools had a higher percentage of students who achieved at proficient and mastery levels in mathematics than comparable schools, despite high percentages of students from lower SES backgrounds and a high percentage of Black students. They concluded that schools that were strong in three or more of the five essential support areas tended to achieve higher outcomes than schools that were strong in only one area or none. Therefore, Bryk et al.'s (2010) framework provided a lens in this study which helped to make sense of the practices and strategies that prepare students in general and particularly for advanced mathematics classes and supported them in acquiring the competencies to complete such classes successfully.

Bryk et al. (2010) suggested that schools are complicated organizations consisting of people and groups with interdependent responsibilities. Because most researchers agree that school leadership is an essential component in promoting student achievement, the framework is anchored by school leadership, most notably, the principal. Professional capacity follows, because the school staff must have the capacity and behaviors to attain the goals set forth by leadership (Bryk et al., 2010). Professional capacity includes instruction, quality professional development, continuous improvement, and a professional teaching community that holds high expectations for the principal, teachers, students, and extended community (Bryk et al., 2010). Instructional capacity is another important feature of the framework that includes (a) quality subject matter content and adequate pacing, (b) guidance in teaching for higher level thinking, and (c) professional development opportunities for teachers to learn inquiry-based teaching methods in order to encourage advanced levels of thinking and learning. The model also includes a student-centered learning climate, in which children, teachers, parents, and community members feel safe (Bryk et al., 2010). Finally, the framework includes community ties through which a partnership is created between the school, the parents, and the extended community. High performing schools build positive and productive relationships with students' families and the broader neighborhood and community. According to Bryk et al. (2010), parent-school community ties are created by building opportunities for parents to learn and support their child's learning, understanding the student's home life, and developing school-community partnerships.

In summary, the framework offered by Bryk et al. (2010) captures the strategies and practices of effective schools as found by the researchers. The “five essential supports” provided a conceptual framework for the people, practices, programs, and strategies that should be examined when studying how a middle school provides Black students with opportunities to access and successfully complete a challenging mathematics curriculum.

### **Purpose of the Study**

The purpose of this study was to examine, describe, and analyze how one middle school developed and implemented practices, strategies, and policies to prepare and support Black enrollment and achievement in advanced mathematics classes. As a middle school administrator, my interest was with examining the experiences of central office personnel, school administrators, teachers, and guidance counselors as they engaged in the day-to-day work of providing students with a challenging mathematics curriculum, delivery of instruction, and quality learning experiences.

### **Research Questions**

Roberts (2010) suggested that good research questions guide a study and provide the structure for presenting the results. This study was guided by this primary research question: What were the policies, practices, and strategies that one middle school used to prepare Black students for and support Black student enrollment and achievement in advanced mathematics classes? In order to thoroughly explore the primary research question, key concepts from the literature review and the “five essential supports” framework were used to consider the roles of school leadership, professional capacity, a student-centered learning climate, instructional guidance, and parent-community ties as the school’s policies, practices, and strategies were studied. Hence, the following questions were explored:

- What specific policies, practices, and strategies were used to encourage and sustain Black student enrollment and achievement in advanced mathematics classes at the middle school level?
- How did school and district personnel use these policies, practices, and strategies to influence Black students’ achievement in mathematics?

- What barriers impeded Black student enrollment and/or achievement in advanced mathematics classes?

### **Significance of the Study**

Middle schools have limited guidance regarding specific practices, policies, and strategies that prepare and support student enrollment and achievement in advanced mathematics classes (Achieve, 2008; Anderson & Chang, 2011; Harper et al., 2009; Riegle-Crumb & Grodsky, 2010; Sowell, 2001). Few studies have examined how schools prepare and support student achievement and enrollment in advanced mathematics classes or have “identifie[d] what approaches unlock [the] natural learning and motivation for even the most disenfranchised and alienated” (McCombs, 2000, p. 29). This study examined and documented middle school level policies, practices, and strategies that supported student preparation, enrollment, and achievement in advanced mathematics classes. This study also identified potential barriers to enrollment and achievement in such classes.

This study adds to the knowledge base about mathematics education and closing the minority achievement gap. The findings from this study can serve as a guide for other schools that may be interested in preparing students for and supporting students’ enrollment and achievement in such classes since mathematics achievement is a challenge for educators (Brosnan, Schmidlin, & Grant, 2013). Policymakers, superintendents, principals, teachers, and other school personnel can use the results of this study as a guide to practices and strategies that one successful middle school used to increase the number of Black students taking and succeeding in advanced mathematics courses. The results of the study can be used for professional development and the development of mathematics programs. At the collegiate level, school leadership and teacher preparation programs may use the results to better prepare graduates to ensure that mathematics programs and practices specifically meet the needs of all students, but especially Black students who are more likely to be enrolled in low level classes than advanced mathematics classes (Adelman, 2007; Darling-Hammond, 2004; Marston, 2013; Walker, 2007).

## **Overview of the Methodology**

The methodology for this study was a single-case study design. The case study approach provided the best means of studying a middle school that had worked to improve students' mathematics achievement (Yin, 2009). The study required an on-site examination of practices, policies, and strategies that prepared and supported student achievement in advanced mathematics classes. The primary sources of data for this study were participant interviews of school personnel who had a direct or indirect impact on mathematics achievement, an analysis of school-related documents, and on-site observations. Study participants and school related documents were assigned identifying codes (such as "A1" for Administrator 1, "T1" for Teacher 1, "GC1" for guidance counselor 1, "MC1" for mathematics consultant, and "D1" for Document 1) in order to preserve the confidentiality of the participants in the study and the school site.

## **Assumptions, Limitations, and Delimitations**

A number of assumptions, limitations, and delimitations were considered during this study. Assumptions are defined as what the researcher takes for granted during the study (Simon, 2011). For example, it was assumed that the participants in this study would answer the interview questions openly and honestly. The basis for this assumption was that their confidentiality was preserved, a member check was implemented to ensure accuracy of the interviews and responses, and participants were allowed to withdraw at any time (Simon, 2011).

Limitations are defined as "potential weaknesses" in a study that were out of the researcher's control (Simon, 2011, p. 1), often related to methodological issues. The primary limitation of the study is the choice to examine the individuals, practices, and programs at one public middle school in Virginia. Consequently, the results may not be representative of other middle schools. Another limitation is that the Black student population was not as large as originally intended; however, the population was sufficient to observe the topic of interest. The third limitation might be the lack of another researcher replicating the study, given that the case study took place in the unique setting of the participating school (Wiersma, 2000). Delimitations are defined as how the researcher has narrowed the scope of the study (Roberts, 2010). For example, the purpose of this study was to examine the practices, procedures, and strategies at one middle school that supported Black student enrollment in advanced mathematics classes, rather than at an elementary or a high school. This study examined the experiences of targeted school

personnel who were directly or indirectly related to mathematics achievement such as mathematics teachers, administrators, mathematics specialist, and guidance counselors and not necessarily other school related personnel. This study did not examine the students, the parents, or the extended community's experiences or opinions. However, the findings from the participant interviews did suggest the direct or indirect impact these individuals had on students' mathematics achievement.

### **Definitions of Key Terms**

The following definitions were used for the purpose of this study:

***Achievement*** – Students' mastery of basic skills, ability to problem-solve and apply mathematics concepts to real-life situations (Brosnan, Schmidlin, Grant, 2013).

***Achievement gap*** – The achievement gap refers to the differences in academic performance among student groups (VDOE, 2012).

***Advanced Mathematics Classes*** – For the purpose of this study at the middle school level, advanced mathematics classes are defined as honors, high level, Algebra I, and Geometry classes, which tend to have higher "academic intensity" than lower leveled mathematics classes.

***African American or Black students*** – African American or Black refers to people of African ancestry in the United States. Black or African American will include students of mixed ancestry, if indicated in school demographics. The term Black is the term most commonly found in reports relating to the subgroup status or ethnicity of students (U. S. Department of Commerce, 2001a).

***Algebra*** – Algebra is a branch of mathematics that focuses on the use of non-numerical variables, analyzing and representing linear functions, and solving linear equations (Mastin, 2010).

***AMO*** – AMO is referred to as Annual Measureable Objectives under Virginia's approved Elementary and Secondary Education Act waiver application. Schools must meet increasing targets yearly in reading and mathematics for all students (VDOE, 2012).

***College*** – College refers to a postsecondary educational institution.

***Course rigor*** – Course rigor refers to the difficulty of a selected course at the middle and high school level. Courses such as "Honors" and "AP" courses tend to be more rigorous.

**Educational attainment** – Educational attainment refers to the highest level of school attended and completed (Aud et al., 2010).

**High school** – High school is any secondary school offering the final classes necessary for graduation.

**Highly qualified teacher** – The *No Child Left Behind Act of 2001* requires all teachers of core academic subjects to be “highly qualified”. A highly qualified teacher is defined as a teacher who is fully licensed by the state, has at least a bachelor’s degree, and has demonstrated competency in each subject taught (NCLB, 2001).

**Instruction** – Instruction refers to the methods used to teach students the intended learning objectives: lectures, discussions, hands-on activities, experiments, role-playing, group work, visuals, writing, explaining, and applying.

**Middle school** – Middle school is any secondary school, Grades 6-8, established to transition young adolescents into the high school environment.

**Minority student** – The term minority student is used in this study to refer to racially, ethnically, linguistically, or culturally diverse students. Specifically, this includes Asian, Black, Hispanic, Native American Indian, and other culturally diverse students (U.S. Department of Commerce, 2001a)

**No Child Left Behind** – Elementary and Secondary Education Act is the primary federal law affecting K-12 education. The most recent reauthorization of the law is also known as the *No Child Left Behind Act of 2001* (VDOE, 2013).

**Standards of Learning (SOL)** – The SOL for Virginia Public Schools describes the expectations for student achievement in Grades K-12 (VDOE, 2014).

**Standards of Learning (SOL) Testing Performance Levels** – Student performance on SOL tests is graded on a scale of 0-600 with 400-499 representing pass proficient and 500-600 representing pass advanced levels (VDOE, 2011).

**Targeted Assistance schools** – Federal funds are provided to identified schools that serve a select group of identified educationally disadvantaged students who are behind or at-risk of failing (VDOE, 2013).

**Title I schools** – Title I embraces school-wide services designed to help low-income children who are behind academically or at risk of falling behind. Title I funding is based on the

number of low-income children in a school, generally those eligible for free lunch or reduced-fee lunch programs (VDOE, 2013).

### **Organization of the Study**

The study is divided into five chapters. Chapter 1 presented an introduction to the topic, statement of problem, historical context, conceptual framework, purpose of the study, significance of the study, research questions, definitions, and the assumptions, limitations, and delimitations of the study. Chapter 2 presents a literature review that discusses why advanced mathematics classes are important for students, especially Black students, the factors that hinder Black student enrollment in advanced mathematics classes, and the role schools play in supporting student access to such classes. Chapter 3 describes the research methodology, research design, study setting, participants, instruments used to gather the data, procedures followed, and data analysis procedures. Chapter 4 includes the findings of the study. Chapter 5 presents a discussion of the study findings, implications, recommendations for further research, and a conclusion.

## **Chapter 2**

### **Review of the Literature**

#### **Background**

Closing the achievement gap has been a focus of education reform in the United States since the Coleman Report in 1966, yet the achievement gap remains between different ethnic groups (Aud et al., 2010), particularly between minority students and their White counterparts. The achievement gap matters because it leaves a disproportionate amount of minority students unprepared for later educational and job opportunities (Achieve, 2008).

Researchers indicated that minority students are underrepresented in advanced mathematics classes (Geiser & Santelices, 2004). This fact may reflect the achievement gap or may be considered one of the causes of it. The underrepresentation of minority students in high level and honors mathematics classes is a concern among researchers and educators (Adelman, 2006; Boykin & Noguera, 2011; Darling-Hammond, 2004; NCTM, 2008; Walker, 2007). In particular, the level of mathematics courses that a student takes in middle school is of concern, because those courses affect educational placement in high school, which in turn affects the student's choice of courses, experience of academic intensity, exposure to quality of instruction, and even graduation (Adelman, 2006, 2007; Darity et al., 2001; Darling-Hammond, 2004; Ladson-Billings, 1997; Li & Hasan, 2010).

#### **Purpose of the Literature Review**

The purpose of this literature review was to examine existing empirical research about the factors that affected the enrollment of minority students in advanced mathematics classes in middle school and their success in such classes. The review is organized into three topics: (1) the reasons advanced mathematics classes are important for students to take; (2) the factors that impact minority representation in advanced mathematics courses; and (3) the role of schools in increasing the access of minority students to advanced courses. Together, these three topics provide an overview of the scope of the problem and also insight into the specific variables that influence the representation of minority students in advanced classes. This review discusses the causes of disparities in mathematics education and points the direction of this study.

## **Importance of Advanced Mathematics Classes**

This section discusses why it is important for students, particularly minority students, to participate in advanced mathematics classes at the middle school level. This portion of the literature review will discuss (a) the effects of mathematical placement decisions (Achieve, 2008; NCTM, 2008; Nomi, 2012; Riley, 1997; Walker, 2007) and (b) the importance of advanced mathematics classes for minority students (Achieve, 2008; Adelman, 2006; Daggett, 2005; Darling-Hammond, 2005; Hattie, 2003; Stronge, 2007).

### **The Effects of Mathematical Placement Decisions**

Challenging mathematics classes benefit students more than low level mathematics classes do (Ellington & Frederick, 2010; Ladson-Billings, 1997; Walker, 2007). Nomi (2012) suggested that middle school students in honors and advanced classes such as Algebra I often have exposure to a “more challenging curriculum, have teachers who hold higher expectations, and experience less disruptive environments than students in low-ability classes” (p. 490).

Each decision about a student’s placement in a mathematics course affects future opportunities. This is especially true of placement decisions concerning algebra. Educators consider Algebra I the “gateway” course to advanced mathematics courses (Adelman, 2007; Berry, 2005; Cooney & Bottoms, 2002; Dougherty, 2010; Riegle-Crumb & Humphries, 2012). Most advanced high school mathematics classes require Algebra I as a prerequisite. Students who take Algebra I in the eighth grade have access to a “wide range of mathematical topics” (NCTM, 2008, p. 1) and opportunities. Students who take Algebra I in eighth grade can take Geometry and Algebra 2 by the sophomore year in high school, making calculus achievable by the senior year. In contrast, students who do not take Algebra I until high school are unlikely to progress into calculus by their senior year. Thus, students who take Algebra I in eighth grade and more advanced mathematics courses in high school gain an advantage over their peers because the best predictor of college admission and completion is whether a student has taken advanced mathematics classes in high school (College Board, 2012).

Students who take Algebra I in middle school gain other advantages over their peers. Algebra enhances the ability to “generalize mathematical ideas and relationships, which can be applied in a wide variety of mathematical settings” (NCTM, 2008, “Algebra: What, When,” para 2). Unlike lower track classes, algebra provides the necessary foundation for advanced

mathematical skills such as using formulas, reasoning, and problem-solving (Achieve, 2008). Algebra I also provides exposure to “conceptual building, challenging questioning, and connection making” (Brosnan, Schmidlin, & Grant, 2013, p. 349).

### **Importance of Advanced Mathematics Classes for Minority Students**

Students’ access to a high quality curriculum and effective instruction has a significant impact on academic achievement, especially for minority students (Adelman, 2006; Allensworth, Nomi, Montgomery, & Lee, 2009; Darling-Hammond, 2005; Darling-Hammond, Berry, & Thoreson, 2001; Hattie, 2003; Schott Foundation, 2009; Stronge, 2007; Tate, 2005). Minority students benefit from taking advanced mathematics classes for several reasons. First, access to advanced mathematics classes can decrease achievement gaps by enabling students to increase future academic opportunities and enroll in more challenging high school courses (Achieve, 2008). Second, studies have revealed that students of all income levels who take rigorous mathematics courses are more likely to attend college (Adelman, 2006; Riley, 1997). Third, acquiring strong mathematics skills is important for competing in the global job market (Wang & Goldschmidt, 2003).

Minority students’ early access to challenging mathematical experiences is a critical factor in decreasing academic achievement gaps. Taking Algebra I early enables students to access honors and advanced mathematics classes in high school (Adelman, 2006; Berry, 2005; Carbonaro, 2005; Ellington & Frederick, 2010; Gamoran & Hannigan, 2000; Ladson-Billings, 1997; Levasseur & Cuoco, 2003; Nomi, 2012; Nunez, Bugarin, & Warburton, 2001; Protheroe, 2007; Seeley, 2005; Wang & Goldschmidt, 2003). The work usually involves complex process standards that provide challenging tasks that help students develop a deeper understanding of concepts as well as how to apply them (Cai & Lester, 2010). Advanced mathematics classes that include problem-solving tasks impact higher-order thinking skills and mathematics preparation for advanced learning (Burris, Heubert, & Levin, 2004; Cai & Lester, 2010; Levasseur & Cuoco, 2003).

Spielhagen (2006) suggested that educators must consider equitable opportunities that provide minority students with access to a challenging curriculum. Providing students with access may ease some of the difficulty minority students experience in gaining mathematics proficiency. How well students acquire these mathematical skills, terms, and concepts may be

determined by the support that is provided (Nomi, 2012). In accord with other studies (Burris et al., 2004; Cooney & Bottoms, 2002; Gamoran & Hannigan, 2000), the National Research Council [NRC], 2010) reported that most students can achieve mathematical proficiency if given adequate time and multiple opportunities. The NRC (2010) found, in a large-scale study of 150-classrooms serving low-income students, that those classrooms that provided challenging mathematical opportunities and supported students' understanding and application of concepts and skills produced stronger results than those classrooms that offered a traditional curriculum. The NRC (2010) contended that not allowing disadvantaged students to participate in challenging course-work places these students at a disadvantage. Other studies have contradicted NRC's (2010) view, as will be discussed later in this review; however, NRC argued that:

The study of Algebra need not begin with a formal course in the subject. The elementary and middle school curriculum can support the development of algebraic ways of thinking and thereby avoid the difficulties many students experience in making the transitions from arithmetic to algebra. The basic ideas of algebra can be learned by the end of middle school if they are taught in ways that draw on and develop all strands of math proficiency. (2010, p. 29)

Nunez et al. (2001) contended that minority students who took rigorous classes and had exposure to challenging tasks in middle and high school, regardless of their parents' educational level, did just as well academically as White students. Some researchers would disagree with this assertion, contending that there is still an achievement gap between minority students and their White peers even in rigorous courses (Ferguson, 2007; Lee, 2004; Ogbu, 2003). Still, research has shown that a student who has had exposure to challenging mathematics instruction, and additional supports such as remediation and extension opportunities have increased chances of taking advanced courses (Achieve, 2008; Bol & Berry, 2005; Dougherty, 2010). For example, the opportunity for students to enroll in Pre-Algebra classes early in their education programs affords them more academic preparation and support, which then impacts their ability to enroll in advanced classes at the high school level (William & Bartholomew, 2004). In contrast, students who lack the appropriate academic preparation are unable to complete more advanced mathematics courses at the high school level (Adelman, 2006, 2007; Walker, 2007). As Tate (2005) stated, "It is not shocking that a positive relationship between mathematics [preparation] and course-taking exists" (p. 16).

High school mathematics course-taking is strongly linked to middle school course-taking (Achieve, 2008; Adelman, 2006; Ellington & Frederick, 2010; Geiser & Santelices, 2004). Nunez et al. (2001) examined the role of academic preparation in high school and the influence rigorous courses have on postsecondary success. Their study followed college students for three years (1995-1998) and found that those college students who were successful at the postsecondary level were more likely to have completed rigorous courses in middle and high school. Like Nunez et al. (2001), Choy (2001) found that completion of a bachelor's degree was strongly associated with the mathematics courses that students take in high school. Like Choy (2001) and Nunez et al. (2001), St. John and Chung (2006) argued that students having access to rigorous high school math courses created favorable conditions for college success. All things considered, St. John and Chung (2006) contended that the quality of schools and mathematical preparedness helped to explain why some students achieve. Therefore, some researchers have stated that schools need to emphasize academic preparation in mathematics (Dougherty, 2010; Riley, 1997).

Rigorous mathematics courses in middle school also impact future job opportunities (Burris et al., 2004; VDOE, 2010). Riley (1997) suggested that "Workers who have strong mathematical backgrounds were more likely to be employed and receive higher wages" than those individuals who did not have a strong mathematical background (p. 13). The NRC (2010) stated that, if students are to compete in tomorrow's job market, then schools have the responsibility to help students see mathematics as an essential tool for college and job attainment, as well as life-long aspirations. Otherwise, students will have "limited opportunities to pursue higher levels of education and to compete for good jobs" (NRC, 2010, p. 3).

Students must possess specific skills such as critical thinking, problem solving, communicating (Boykin & Noguera, 2011; Chubb & Moe, 1990; Kirsch, Braun, Yamamoto, & Sum, 2007) and strong mathematical skills to achieve success in the 21<sup>st</sup> century jobs market (Zuckerman, 2011). Mathematical skills, such as conceptual, logical, and procedural thinking (NRC, 2010), can transfer into technical, scientific, and medical jobs. Daggett (2005) suggested that offering students a rigorous curriculum "benefits all students because they will be challenged to achieve academic excellence, which ultimately boils down to applying knowledge to unpredictable, real-world situations" (p. 5). Therefore, the students who will be tomorrow's managers, professionals, and civil and business leaders need to have access to challenging

mathematics classes to be adequately prepared for future opportunities (Riegle-Crumb & Grodsky, 2010).

In summary, providing students with opportunities to take Algebra I in middle school will increase the chances for those students to enroll in advanced mathematics classes in high school. While advanced mathematics classes are important for every student to succeed, they are especially important for minority students in order to close the achievement gap (Walker, 2007). Minority student participation in advanced mathematics classes also opens doors to future educational and employment opportunities and helps level the playing field (Achieve, 2008; Spielhagen, 2010).

### **Minority Representation in Advanced Mathematics Courses**

Minority students remain underrepresented in advanced mathematics classes and lag behind their White peers in terms of achievement (Burriss et al., 2004; Darling-Hammond, 2004; Ferguson, 2007; Ladson-Billings, 1997; Loveless, 2008). Most minority students do not take Algebra I at the middle school level despite its importance (Burriss et al., 2004; Ladson-Billings, 1997; NCTM, 2008; National Mathematics Advisory Panel [NMAP], 2008; Riley, 1997; Walker, 2007). Research has shown that Hispanic and African American students are disproportionately overrepresented in remedial and basic mathematics classes, underrepresented in algebra, and perform at or below basic levels on national mathematics assessments (Spielhagen, 2010; Wang & Goldschmidt, 2003). The National Assessment of Educational Progress (NAEP) mathematics test results during the 2011-2012 school year showed that 84% of White eighth graders, in comparison to 56% of minority eighth graders, performed at the proficient level, while approximately 16% of White and 44% of minority eighth graders performed at below basic level (NCES, 2013). Therefore, this portion of the literature review focuses on factors that explain why minority students are underrepresented and underperforming in advanced mathematics classes.

Darling-Hammond (2004) expressed grave concern about who is entitled to “high quality educational opportunities at every level of schooling” (p. 214) since the future is based on critical thinking, problem-solving, reasoning, and communicating. Exposure to a challenging curriculum provides opportunities for students to learn the interwoven and interdependent skills necessary to

complete advanced mathematics learning (NCR, 2002). Ferguson and Mehta (2004) added to Darling-Hammond's (2007) point stating that:

While there has been considerable debate in the academic literature about how much school-level factors affect achievement independent of student backgrounds, it is undeniable that the interaction of poverty, segregation, and inadequate school resources heavily disadvantage the poor and minority students. (p. 661)

A variety of complex personal and school factors place many Black students at a disadvantage for access to rigorous courses (Chen & Carroll, 2005; Choy, 2001; Martin-Lohfink & Paulsen, 2005; Smith, 2008). Personal factors include (a) socioeconomic status (Azzam, 2008; Boykin & Noguera, 2011; Darling-Hammond, 2004; Ogbu, 2003); (b) parental influence (Choy, 2001; Lee & Bowen, 2006; Orr, 2003; Walker, 2007); and (c) student effort (Carbonaro, 2005; Ferguson, 2007; Hattie, 2003; Ogbu, 2003). School factors include (a) school policies (Adelman, 2007; Lee, 2004; Riegle-Crumb & Humphries, 2012); (b) teacher quality, expectations, beliefs, and relationships (Achieve, 2008; Darling-Hammond, 2005; Hattie, 2003, 2009); and (c) high poverty schools (Aud et al., 2010; Planty et al., 2009).

### **Socioeconomic Status (SES)**

As far back as 1966, Coleman and colleagues found that a family's SES and the neighborhood where they lived were important determinants of educational outcomes (Lee, 2004). Although not every Black student suffers from low SES, the relationship between minority status and low SES remains strong. For example, Robbins, Stagman, and Smith (2012) reported that most Black, American Indian, and Hispanic children come from homes in rural and urban areas with a disproportionately low income. They indicated that 65% of Black children, 65% of Hispanic children, and 63% of American Indian children lived in poverty in comparison to 31% of White children. Low-income minority students are likely to live in high poverty, segregated communities and neighborhoods (Resnicow et al., 2001). Minorities often live in communities that experience low economic development, limited access to medical care, and low levels of educational attainment (Jensen, 2009; Marston, 2013). Boykin and Noguera (2011) asserted that "Race, class, and cultural differences between students and teachers certainly do not cause the achievement gap; however, they do contribute to its persistence and often complicate efforts to reduce or eliminate disparities in student learning outcomes" (p. 29).

Additionally, economically disadvantaged students are more likely to enter school with limited educational experiences. According to Lee and Bowen (2006), children from low economic backgrounds tend to have fewer academic experiences than children from middle-class backgrounds. Educators and researchers continue to ponder how to improve educational opportunities for some children in low SES situations. Chen and Carroll (2005) argued that, while there are cultural and societal forces at work in some disadvantaged families that pull minority students away from taking rigorous classes in middle and high school, there are also academic limitations that may hinder their access to advanced courses.

*Young Children At-Risk*, a report from the National Center for Children in Poverty (Robbins et al., 2012), stated that children and youth who live in poverty are affected by many risk factors, such as academic failure and poor health, due to family economic situations. Lee and Bowen (2006) argued that families in economically disadvantaged situations are less likely to come to the school to get information to help their children, which can negatively affect academic achievement. Minority students coming from low-income families appear “to have less access and less ability to compete in the arena” (Smith, 2008, p. 147). Therefore, students classified as both minority and low-income seem to have greater social and cultural challenges and are less likely to achieve at the same level as their counterparts.

Despite the consensus regarding the link between SES and achievement, some researchers have questioned the apparently simple connection between wealth and student achievement (Sirin, 2005). Sirin (2005) suggested that multiple factors explain why SES influences student achievement, including related home conditions, community environments, health access, and the intensity and length of poverty. For example, a child may have poor family relations and have limited connections outside the home, such as school and community, which can translate into poor academic achievement.

## **Parental Influence**

Parental involvement, school experiences, and expectations may influence minority student achievement and access to advanced mathematics classes (Hornby & Lafaele, 2011). Students with involved parents tend to do better in school (Grolnick, Raftery-Helmer, & Flamm, 2013; Hoover-Dempsey & Sandler, 1997; Hornby & Lafaele, 2011; Jeynes, 2007) and take advanced classes early in their school career (Riley, 1997). Hoover-Dempsey and Sandler (1997)

defined parental involvement as a range of activities that promoted children's learning in school, including overseeing homework, monitoring academic progress, discussing school events or course decisions, attending parent conferences, going on field trips, and volunteering at school. As Jeynes (2007) explained, "parental involvement may be one means of reducing the academic achievement gap that exists between White students and some racial minority groups" (p. 103).

Knowledgeable and involved parents work to ensure that their children receive a good education (Lee & Bowen, 2006), including requesting that their children be placed in upper level courses (Warner, 2010). But many minority parents do not know how to advocate for their children to get placed into high level classes, so schools often do not place in advanced courses those minority students who might otherwise qualify or demonstrate potential (Walker, 2007). Ferguson (2007) and Walker (2007) argued that parents want their children to take advantage of opportunities to learn and excel, but they may not be able to help them with their mathematics assignments or help select rigorous courses if the opportunity to select such classes arises.

Parents' experiences in school also play a role in how they proceed with helping their children in school. Some parents who performed poorly in school themselves may have a negative attitude toward school and educators (Hoover-Dempsey & Sandler, 1997). These negative parental attitudes may increase as students approach the secondary level, when students face more challenging courses (Hornby & Lafaele, 2011).

In addition, some parents may try to protect their children from the type of negative experiences in mathematics that the parents experienced when they were in school (Morrison-Gutman & McLoyd, 2000). These parents can impact their children's mathematical achievement by discouraging participation in advanced courses (Grolnick et al., 2013; Hornby & Lafaele, 2011). These parents often do not consider themselves as equipped with strong mathematical skills, tend to view their children as having low abilities in mathematics, and, therefore, will not get as involved in their children's education (Hoover-Dempsey & Sandler, 1997; Hornby & Lafaele, 2011; Morrison-Gutman & McLoyd, 2000).

Parental expectations about whether their children will attend college also play an important role in course selection in middle school and high school. In some minority, low-income families, the parents view a high school diploma as an acceptable level of achievement for job preparation, so they do not push college attendance for their children (Smith, 2008) for various reasons. These parents may not hold an expectation for their children to excel in school

and may communicate that low level classes are adequate (Hornby & Lafaele, 2011). These parents may not realize that the skills necessary for today's jobs differ significantly from the skills necessary for tomorrow's STEM-dominant job market or that students with a strong grasp of mathematics have an advantage academically and in the job market (Zuckerman, 2011).

### **Student Effort**

Barkley (2008) and Carbonaro (2005) studied the relationship between student effort and school level factors and found that students put forth more effort in challenging classes. Carbonaro (2005) defined effort as “the amount of time and energy that students expend in meeting the formal academic requirements established by their teacher and/or school” (p. 28). Barkley (2008) and Carbonaro (2005) asserted, based on teacher surveys from the NELS:88 data set, that students' learning depended heavily on both student effort and the rigor of the mathematics classes. The time a student spends on an academic task and the effort put forth in understanding and completing the task correctly contributed to students' learning and academic success in advanced classes (Nickerson & Kritsonis, 2006).

Researchers do not agree about the reasons why students put forth different levels of effort. Some researchers suggested that schools could promote effort in their students by creating an environment with structure, effective teachers, and classroom conditions that stimulate and encourage students to work hard (Frome & Dunham, 2002; Matsumura, Slater, & Crosson, 2008). Other researchers argued that effort is related to student characteristics and backgrounds (Fordham & Ogbu, 1986; Ogbu, 2003; Wang & Goldschmidt, 2003). Steele (1997) has argued that, in some cases, Black students may not want to be identified as high achievers, especially in the eyes of their peers. As a result, they may put forth minimal effort even though they can do the work and belong in advanced classes.

While acknowledging that student effort predicts academic success, Stewart (2008) suggested that the “association between [effort] and academic achievement is more complex than originally thought” (p. 199). Student effort may be tightly interwoven with other factors that influence student achievement such as the student's academic values, academic behaviors, academic aspirations, peer affiliations, cultural differences, and family conditions (Stewart, 2008). Still, Ogbu (2003) posited that lack of student effort can contribute to mathematical achievement gaps and Black student underrepresentation in advanced classes.

Analysis of effort is controversial because student effort is difficult to measure. In contrast to assessing students' knowledge of multiplication facts or quadratic formulas, Ferguson (2007) contended that gathering quantitative data on effort could be problematic. For instance, data collection from teachers can be misleading, especially if the teacher correlates only grades with effort. For example, a student may spend many hours studying and then experience failure on an assessment. Ferguson (2007) maintained that it was difficult to know if what teachers perceived as student effort was accurate, especially when other factors are present such as school policies which will be discussed in the next section.

### **School Policies**

School policies can contribute to under-identifying minority students for high level courses. Riegle-Crumb and Humphries (2012) stated that Black students were less likely to enroll in and complete advanced-level courses, at times due to school policies. Some school districts have policies that determine students' placement in leveled courses. Those policies may include using standardized test scores, grades, GPA, ability grouping, and teacher recommendations for placement (Ogbu, 2003). Griffin and Allen (2006) studied school-level factors such as course enrollment, expectations, and school policies at two high schools with different demographics. The researchers concluded that just because a high school offers rigorous courses does not mean the school staff will encourage all students to take those courses. Therefore, Lee (2004) asserted that "schools need to broaden their perspectives of equity and be more aware of potential biases in their efforts to address the achievement gap" (p. 52) between different groups of students.

Holt and Campbell (2004) examined the effects of school policies on mathematics achievement as students transitioned from middle to high school. They found that school policies could improve or hinder achievement for students, thereby "closing [or widening] the achievement gap between racial majority and minority students" (Holt & Campbell, 2004, p. 2). For example, Holt and Campbell (2004) argued that schools with policies that emphasized parental involvement had greater mathematical achievement than schools without such policies. They also confirmed the importance of academic counseling. Schools with policies that required academic counseling for all students in mathematics placements from Grades 8 through 12 had

greater achievement and enrollment in advanced classes than those schools that did not promote or require academic counseling.

Supporting students with academic planning at the early stages of learning can encourage more students to prepare for advanced learning as they reached the high school and postsecondary levels. Darity et al. (2001) examined survey data from 224 middle schools and 231 high schools that were obtained from parents, teachers, counselors, and principals, in order to evaluate the underrepresentation of Blacks and at-risk students in AP, honors, and gifted programs. They found that 90% of the high schools offered advanced courses, while 45% of the middle schools reported offering honors courses. Algebra I in eighth grade was the most common honors course offered in middle school. The study showed large enrollment differences between schools. For example, in one school, Black students made up 28% of the student body, and 40% of the Black students enrolled in AP Calculus. In another school, Black students made up 40% of student body, but 0% of those students enrolled in AP Calculus. Overall, only 18% of the schools reported that they had programs to prepare and support students in honors and AP courses. However, the schools that made efforts to increase minority representation in advanced classes had a higher percentage of participation (Darity et al., 2001).

Some school districts have policies that all students should take a challenging mathematics class in their educational career. Some school districts encourage students to take Algebra I in the middle grades (Williams, Haertel, Kirst, Rosin, & Perry, 2011) so they may have opportunities to take advanced mathematics classes in high school. The controversial Acceleration-for-All policy (some districts refer to this policy as Algebra-for-All) is one such policy.

Much research suggests that the Acceleration-for-All policy is beneficial. South Side Middle School in New York implemented an accelerated mathematics program for interested students over a six-year period. Longitudinal data revealed positive results for some students of different socioeconomic levels and racial backgrounds with the support of faculty, community, and organizational changes (Burriss et al., 2004). Nomi (2012) examined Chicago Schools' test data from 1994-1999 to determine the impact of the Algebra-for-All policy on the outcomes of advanced students. During the initial implementation of the policy, skill levels and test scores declined for some students. When the Algebra-for-All policy was revised, the schools used homogeneous grouping for Algebra I classes instead of heterogeneous grouping, provided

additional instructional time and support for struggling mathematics students, and implemented professional development that supported algebra instruction. These revisions to the policy raised student achievement for all students, since additional support for students and teachers proved to be important (Burriss et al., 2004; Walker, 2007).

However, some researchers questioned the benefits of the mathematics Acceleration-for-All policy (Allensworth et al., 2009; Daggett, 2005; Loveless, 2008), particularly whether enrolling in Algebra I benefits students who are not mathematically prepared. Loveless (2008) analyzed the scores of 160,000 students on the eighth grade NAEP math assessment using data from 2000, 2005, and 2007. Based on his findings, Loveless (2008) argued that enrollment in Algebra courses should be limited to students who are ready to handle the rigor of advanced mathematical classes. Loveless stated that struggling learners may hinder advanced learners because teachers must spend more time working with struggling learners rather than moving advanced learners to the next level. Nomi (2012) supports this claim to some extent, but also shows that schools can enact policies, such as student grouping patterns, to avoid these issues. In response to Loveless's (2008) study, Burriss (2008) argued that the true issue is the inadequate preparation of minorities and low-SES students for success in algebra. Nevertheless, Allensworth et al. (2009) were unwilling to suggest that the policy was not good for all students. They concluded that districts needed to review their curriculum for quality and the effectiveness of the instruction, which is strongly associated with student performance.

Mathematical placement policies can be very controversial. As discussed above, some researchers argued that placing unprepared students in Algebra classes did not serve them well and hindered high achievers from achieving (Lee, 2004; Loveless, 2008). Other researchers contended that it did not matter whether students were in leveled Algebra classes. They argue that all groups made gains in mastery of mathematical concepts (Cooney & Bottoms, 2002; Gamoran & Hannigan, 2000) because the concepts of algebra help to develop reasoning and logical thinking.

Policies are an important consideration because schools can change their policies to enhance Black student participation in advanced courses, but they cannot change the family income or educational attainment of their students (Adelman, 2007). The impact of school policies is a critical consideration in creating a school environment that strengthens access to

advanced courses, but political opposition can make implementing such policies as expanding access to rigorous courses to all students difficult (Boykin & Noguera, 2011).

### **Teacher Quality, Expectations, Beliefs, and Relationships**

Darling-Hammond (2005) discussed the importance of having qualified teachers in classrooms. Retaining qualified teachers in socioeconomically disadvantaged urban and rural classrooms is difficult. As the NCTM explained:

Our states, communities, and school systems are challenged to distribute too few resources to too many places. Students in [poor] neighborhoods have taken the worse hit, sometimes being taught by teachers who are out of field, and rarely having access to high-quality instructional materials. Without a well-qualified mathematics teacher... no student has a chance to achieve his or her potential. (Seeley, 2005, p. 1)

Student access to qualified teachers has an impact on students' acquisition of mathematical skills, which impacts their access to advanced classes.

Teacher quality is a prominent topic among policymakers and researchers across the nation. Teacher quality impacts student mathematical development (Achieve, 2008; Darling-Hammond, 2004, 2005; Darling-Hammond et al., 2001; Ferguson, 2007; Flores, 2007; Hattie, 2003; Pierce, 2001; Stronge, 2007). Teacher experience and qualifications were important predictors of student achievement in mathematics in several studies (Adelman, 1999; Darling-Hammond, 2005; Hattie, 2003; Riegle-Crumb & Humphries, 2012). In a meta-analysis of over 50,000 studies, Hattie (2003) found that of all the variables that affected student achievement, student factors accounted for 50% of the variance in their achievement, while the teacher accounted for 30% of the variance. Therefore, the literature evidences a relationship between teacher quality and student achievement levels (Hattie, 2003).

High quality teachers are especially important for advanced math classes. The work usually involves process standards that provide challenging tasks that help students develop a deeper understanding and application of concepts (Cai & Lester, 2010). When advanced mathematics classes include problem-solving as a part of each lesson, this not only impacts higher-order thinking skills but also mathematics preparation for advanced learning (Burriss et al., 2004; Cai & Lester, 2010; Levasseur & Cuoco, 2003).

Many minority students attend schools where they tend to have teachers with weaker mathematics knowledge and pedagogy. Under-qualified teachers contribute to the mathematical achievement gap (Bol & Berry, 2005; Darling-Hammond, 2004) by impeding students' development in mathematics and ultimately their placement in honors and high-level courses (Darity et al., 2001). In an analysis of several national studies, Darling-Hammond (2004) reported that students in classes with fully certified mathematics teachers showed higher gains in achievement than students whose teachers were not certified in mathematics or were teaching out of their field. Although many factors outside the control of the school influence mathematical development, schools have a stronger chance of closing the achievement gap when "teachers are educated on the most effective teaching methods through professional development and work in a school environment that values quality teaching" (Williams, 2011, p. 70).

Teacher expectations and beliefs also influence the minority achievement gap (Bol & Berry, 2005; Darling-Hammond, 2005; Ferguson, 1998; Ogbu, 2003). When teachers communicate high expectations for all students, they tend to increase learning opportunities (Darling-Hammond, 2005). Bol and Berry (2005) also found that "teacher expectations and beliefs played a role in the kinds of instructional practices implemented to address the achievement gap" (p. 35). They conducted a qualitative study to explore perceptions of secondary mathematics teachers on factors contributing to student achievement and ways to increase achievement. Teachers surveyed in the Bol and Berry study were more likely to "attribute student characteristics to achievement rather than exposure or access to quality instruction" (p. 41).

Hattie (2003) contended that, "it is what teachers know, do, and care about which is very powerful in this learning equation" (p. 2). If some teachers believed that minority students were "[more] or less able for biological or sociological reasons, then they will expect [more] or less of them, [encourage] or push them less, and steer minority students [to or] away from advanced courses" (Darity et al., 2001, p. 11). Studies by Hattie (2003) and Ferguson (1998) supported the idea that teachers' beliefs can either foster or hinder minority preparation for and enrollment in rigorous courses. Ferguson (1998) studied how teacher expectations, perceptions, and behaviors impacted the Black-White achievement gap and concluded that teachers' beliefs could negatively or positively affect a student's achievement as he or she progressed through the different grade

levels. Only a limited number of the reviewed studies (Darity et al., 2001) focused on why teachers held lower expectations, which is an area that needs further research.

Beyond knowing their subject area, teachers who cultivated a positive climate and built strong relationships with their students had students who were likely to be successful (Darling-Hammond, 2005; Hoover-Dempsey & Sandler, 1997). Cornelius-White (2007) found that positive teacher-student relationships showed “correlations for critical thinking, math and verbal achievement, drop-out prevention, reduction in disruptive behaviors and attendance” (p. 134). Conversely, the findings suggested that students might be adversely affected if the relationships are negative. Students are more apt to work and perform for teachers whom they know want the best for them. In other words, the quality of a student’s relationship with his or her teacher can influence academic achievement (Davis, 2013; Patrick, Mantzicopoulos, Samarapungavan, & French, 2008; Pierce, 2001). Teachers who work to create a fair and caring environment are more likely to build a positive relationship with students, which can contribute to students’ academic gains (Casteel, 2000).

Walker (2007) interviewed 21 high-achieving mathematics high school students who were members of minority groups and found that the quality of teacher-student relationships contributed to their mathematics success. The students were more likely to be successful when their teachers provided encouragement and supported their mathematical goals. Similarly, Ellington and Frederick (2010) reinforced the importance of teacher-student relationships when they identified predictors of success for eight high-achieving Black students. Two of the primary predictors were access to accelerated programs and a positive relationship with their mathematics teachers, whose encouragement and support were beneficial to their persistence in mathematics classes. Ellington and Frederick (2010) asserted that the participants’ success stories were just as important as the stories of students from economically disadvantaged backgrounds because these stories demonstrate that positive relationships with teachers contribute to success and persistence in advanced classes.

In many instances, students who had a positive relationship with their teachers tended to have higher academic achievement than those students who held a negative view of their teachers and of their schools (Crosnoe, Johnson, & Elder, 2004). Frome and Dunham (2002) found that, the more guidance and encouragement students received from teachers, “the more likely those students had access to advanced classes” (p. 8). In summary, research shows that

teacher-student relationships can play a critical role in increasing student motivation to learn, influencing academic course selection, and facilitating student achievement.

### **High Poverty Schools**

Black students are more likely to attend high poverty schools (Aud et al., 2010; Flores, 2007; Planty et al., 2009). High poverty schools tend to contribute to the achievement gap in a number of ways (Aud et al., 2010), many of which involve the issues discussed in the previous five sections. The focus here will be on (a) limited student access to advanced courses, and (b) lower student performance.

Students who attend high poverty schools are more likely to encounter limited resources, limited access to rigorous classes, and unqualified teachers (Anderson & Chang, 2011; Azzam, 2008). Ferguson and Mehta (2004) noted that “schools in [poor] areas were less likely to offer college-preparatory classes and have much higher rates of teachers teaching out of subject areas, greater teacher turnover, and lower test scores” (p. 661). In a comparison of the academic gap with school spending by district, Lee (2004) found that “the more impoverished the school or [segregated], the more likely the students achieved at a lower level than students at low-poverty schools” (p. 58).

Students who attend high-poverty schools are more likely to be offered remedial and low-level mathematics classes (Walker, 2007). Griffin and Allen (2006) reported that schools that were heavily concentrated with minority students tended to have fewer resources and were more likely to have a high concentration of remedial classes. These schools also had larger class sizes and fewer rigorous courses.

Wang and Goldschmidt (2003) studied the demographics of students who were enrolled in low, average, or advanced mathematics classes in middle school and high school. They concluded that Hispanic and African American students disproportionately filled low level mathematics classes. The research indicates that some minority students’ mathematical exposure is limited for various reasons which place these students at a disadvantage for accessing advanced mathematics classes. Therefore, the wealth of a state, district, or school can make a difference by enabling the hiring of highly qualified teachers, providing essential resources and professional development, and designing or purchasing programs to support academic achievement in mathematics.

In summary, the research demonstrates that many factors impede minority students' access to advanced mathematics classes. As Adelman (2007) and others (Boykin & Noguera, 2011; Williams, 2011) posited, change will not occur until influences from the school, the student, and the home are adjusted with a focus on values, effort, beliefs, and research-based practices that promote mathematics achievement. The research suggests that if the enrollment of minority students in advanced mathematics classes is to increase, then change has to occur from within the classroom, the school, the district, and the home. The next section of this review focuses on the role of schools in this process.

### **Role of Schools in Increasing Minority Students' Access to Advanced Courses**

Early research identified a student's personal background as having a singularly profound effect on student achievement (Kahlenberg, 2001). However, since the 1970s, scholars have been focusing increasing attention on the role that schools play in supporting student academic achievement (Stringfield & Herman, 1996). After a brief historical overview of this research trend, this section provides an in-depth examination of three specific school-level factors found to increase students' mathematics achievement across racial, ethnic, and SES boundaries: (1) safe and orderly schools, (2) frequent evaluation of student achievement, and (3) strong leadership (Boykin & Noguera, 2011; Chen & Weikart, 2008; Chubb & Moe, 1990; Cotton, 2000; Edmonds, 1979; Levine & Lezotte, 1990; Lezotte, 2002; Marzano, 2003; McNeely, 2013; Whitehouse, 2009).

### **Historical Overview**

Edmonds (1979) synthesized early studies on the urban poor and identified common educational characteristics that were "educationally effective for poor and minority children" (p. 20). Edmonds (1979) observed that, "all children [could] be taught the intended curriculum and held to high standards that enabled students to achieve successfully at the next grade level" (p. 22) if certain school characteristics were in place. Specifically, Edmonds (1979) suggested that schools could support student success by establishing policies and processes that provided access to challenging curriculum and instruction, provided strong administrative leadership, offered a safe and orderly environment, and used research data to guide school efforts. Purkey and Smith

(1983) argued that all schools possess interwoven factors that impact student achievement. These factors can be heavily influenced by the climate of the school.

This research remains meaningful in the 21<sup>st</sup> century. In a re-examination of the Effective Schools research, Lezotte (2002) argued that the intended goal of the Effective Schools research was to “develop a body of research that supported the premises that all children can learn and that the school controls the factors necessary to assure student mastery of the core curriculum” (p. 1). Similarly, drawing on the work of the Schott Foundation (2009), Boykin and Noguera (2011) examined the achievement gap in depth and offered an evidence-based framework that focused on key factors that “[had] direct impact or indirect influence on relevant outcomes and better prepared students for the 21<sup>st</sup> century” (pp. 38-39). They examined five large urban and two suburban school districts, and found that the common policies and practices among the schools that experienced student gains were similar to those found by Edmonds (1979) in the Effective Schools research.

This body of research suggests that schools play an especially important role in promoting student achievement. Many researchers (e.g., Ford & Scott, 2010; Hattie, 2009; Pierce, 2001; Weiher & Tedin, 2006) have contended that schools can do practical things to influence student achievement. Pointing to this growing body of research, Cotton (2000) argued that “educators launching school improvement [such as mathematics reform] can now consult [research] to increase their likelihood of success in improving student performance” (p. 6). Still, Cotton (2000) noted that

Clearly, though, schools cannot undertake to implement the hundreds of new practices identified in the effective practices literature. They must make choices based on locally determined goals, state standards, and other factors. Schools must identify and implement practices that are critical to students’ success; that is, those practices which should be in place for all students in a school to meet their school’s objective: teaching and learning. (p. 7)

In summary, over a thirty-year span, researchers (Berends, Goldring, Stein, & Cravens, 2010; Burris et al., 2004; Chubb & Moe, 1990; Daggett, 2005; Darling-Hammond et al., 2001; Edmonds, 1979; Ellis & Berry, 2005; Lezotte, 2002; Murphy, 1992; Purkey & Smith, 1983, Reeves, 2010) have identified common policies and practices among effective schools that made a difference in student achievement. These research studies used national longitudinal student

data, case studies, and/or school data to examine approaches that promoted student learning and eventually could lead to advanced level classes (NMAP, 2008). The studies showed that certain factors were consistently found in effective schools, including strong stable leadership, high expectations of student achievement, orderly environments, progress monitoring of student achievement, effective educational strategies, quality teachers, and professional development (Edmonds, 1979; Lezotte & Jacoby, 1990; Murphy, 1992; Purkey & Smith, 1983). Because high quality curriculum, quality teachers, and professional development have been discussed elsewhere in this review, this section of the literature review focuses on safe and orderly schools, frequent evaluation of student achievement, and strong leadership (Chen & Weikart, 2008; Chubb & Moe, 1990; Cotton, 2000; Edmonds, 1979; Levine & Lezotte, 1990; Lezotte, 2002; Marzano, 2003; McNeely, 2013; Whitehouse, 2009).

### **Safe and Orderly Schools**

School safety has become a state and federal issue as well as a major concern for educators, parents, and students. Using the combined Crime and Violence Reports from each state, Robers, Kemp, Truman, & Synder (2013) reported that during the 2009–10 school year, 85 percent of public schools reported one or more incidents of violence, theft, or other crimes had taken place, amounting to an estimated 1.9 million crimes. Of those crimes, 689,000 were reported to the police.

Many studies have suggested that a safe and orderly environment is critical to student achievement (Chen & Weikart, 2008; Chubb & Moe, 1990; Cotton, 2000; Edmonds, 1979; Levine & Lezotte, 1990; Marzano, 2003). These studies support the assertion that individuals, regardless of age and position, must feel safe and secure in order for learning to occur (Chen & Weikart, 2008; Cotton, 2000; Lezotte, 2002; Marzano, 2003; Whitehouse, 2009). As Purkey and Smith (1983) noted, “common sense alone suggests that students cannot learn in an environment that is disruptive” (p. 445), so consistent implementation of procedures and rules are necessary for learning to occur.

Henry (2000) asserted that schools must be a safe place for teaching and learning because crime and violence affect the student, the school, and the community. To test Henry’s assertion, Chen and Weikart (2008) studied the impact that school disorder had on the mathematical achievement and attendance of eighth graders in 212 New York City middle schools. Using the

School Disorder and Student Achievement conceptual framework, the researchers found that middle schools that experienced higher levels of school disorder also had lower levels of student achievement in math. Conversely, middle schools with lower levels of school disorder had higher levels of math achievement. Chen and Weikart's (2008) study also noted that middle schools with higher crime and disorder had lower attendance rates. Chen and Weikart concluded that when students viewed a school as unsafe, they avoided the unsafe conditions by not coming to school, and their lower attendance rate affected the students' math achievement. A more direct impact on math achievement also appeared, because undesirable behaviors consistently disrupted the learning environment.

A number of school-wide safety practices identified in the literature are critical for a safe and orderly environment (Cotton, 1999, 2000; Edmonds, 1979; Lezotte, 2002; Whitehouse, 2009). These school-wide practices include (1) all adults must accept that they are on duty at all times, because if students think that no one is watching, then negative behaviors will occur; (2) rules must be enforced with consistency; (3) school must begin quickly and purposefully; (4) teaching and positive reinforcement must be present; and (5) disruptions must be stopped quickly. As Edmonds (1979) noted in his analysis of schools that educated children with low-SES backgrounds effectively, "the schools' atmosphere is orderly without being rigid, quiet without being oppressive and generally conducive to instructional business at hand" (p. 22).

Schools can create safe and orderly conditions for learning that are necessary for academic achievement (Chubb & Moe, 1990). McNeely's (2013) analysis placed strong emphasis on the responsibility of schools to build community within the school (administrators, teachers, staff, and students) and outside the school (families and extended community). Research indicated that a sense of community has a strong influence on student achievement (Jeynes, 2007) and student behaviors. Building community within the school and outside the school has a positive effect on mastery of mathematical skills, critical thinking, mathematical achievement, and thus, access to advanced classes (Brosnan et al., 2013). A school that does not maintain a safe and orderly environment will not educate children effectively (Marzano, 2003).

### **Frequent Monitoring of Student Achievement**

In this era of accountability, schools leaders are asked to participate in continuous school improvement (Marzano, 2003; USDE, 2004) by monitoring school and student data. Data-driven

decision making entails that teachers and principals collect, analyze, and monitor data to guide instructional and school wide practices in order to help improve academic achievement (Ikemoto & Marsh, 2007). Research suggests that, in order to educate children effectively, schools need frequent school-wide and classroom level monitoring systems to track student achievement (Edmonds, 1979; Lezotte, 2002). These systems require the participation of teachers and school leaders to use the data to foster continuous school improvements, thus impacting student learning.

Trimble (2002) conducted a study from 1997-2000 that examined instructional practices of five high-poverty, high-achieving rural and urban middle schools. The researcher focused on “what practices were associated with higher student achievement [beyond] strong leadership, safe and orderly schools, and positive school climate” (Trimble, 2002, p. 9). Trimble identified a common element among the five schools that was also identified in the Effective Schools research: creating data-based goals and programs where key stakeholders had a vested interest in the decision-making processes. In these schools, data-driven goals were monitored often to determine student progress, which helped everyone stay focused on students’ needs and abilities, monitor students’ progress, and monitor school practices and procedures.

Earl and Katz (2002) stated that a good principal understands the importance of analyzing data and creating a culture of school-wide, data-driven, decision-making. Unfortunately, many schools fail to do this well. Leithwood and Seashore-Louis (2011) suggested that neither high nor low data-use schools addressed using data beyond identifying problems in student learning. However, the researchers did find that, beyond setting up systems, in some high-data-use schools principals supported teachers and staff in disaggregating the data and communicating their results. Leithwood and Seashore-Louis (2011) suggest that:

- Data use in schools should be a collective effort involving the principal and teachers in multiple contexts.
- Principal and teachers should have clear purposes for analyzing data linked to student achievement.
- Principal and teachers should have and use data to make school-wide and individual student decisions.

Even though Leithwood, Louis, Anderson, & Wahlstrom (2004) stated that there is some uncertainty about whether data use is a positive factor in student achievement, they found that a

distinct difference exists between low-data and high-data use schools in terms of student achievement. Another factor that may distinguish such schools is the strength of school leadership, which is the subject of the next section.

### **Strong Leadership**

Strong leadership in schools can make a difference in math achievement. Research suggests few, if any, schools produced high math achievement results without the support and commitment of strong school leaders (Leithwood et al., 2004). Improving math achievement requires the combined efforts of teachers, students, and parents, with the school principal in the lead (NRC, 2010). This portion of the literature review will focus on the role of the principal in creating and maintaining a high quality school (Kelley & Peterson, 2009).

The school leadership literature suggests a few key points regarding effective principals. First, a principal influences student achievement indirectly through teachers and others who interact directly with the students (Hallinger, Bickman, & Davis, 1996; Stronge, Richard, & Catano, 2008). Second, schools that serve high at-risk populations and experience high academic achievement most likely have strong leaders who are committed to teaching and learning (Bloom & Owens, 2013). Third, strong principals work to build a positive school climate where students, teachers, and parents feel welcome and valued (Habegger, 2008). Each of these factors will be examined separately.

Research spanning the last 30 years indicates that the role of a principal has an indirect, rather than direct, influence on student achievement (Hallinger & Heck, 1996). Although earlier conclusions from the Effective Schools research indicated that a principal had a direct influence on student achievement (Brookover & Lezotte, 1977; Edmonds, 1979; Sergiovanni, 2001), later studies have indicated that the principal's effect is strongly related to others in the school (Hallinger et al., 1996; Leithwood et al., 2004). More recently, researchers have asserted that strong leadership is vital in schools because of the principal's responsibility to lead and maintain school safety, school reform, and student achievement (Cotton, 2003; Kelley & Peterson, 2009; Leithwood & Seashore-Louis, 2011; Soehner & Ryan, 2011).

Hallinger and Heck (1996) suggest that the relationship between the principal and student achievement "is complex and not easily subject to empirical verification" (p. 6). Similarly, Hallinger et al. (1996) posited that school leadership connects to student achievement through

other people, thus making the effect of a school leader on academic achievement difficult to measure. Leithwood and Seashore-Louis (2011) contend that the quality of shared leadership is linked to student achievement and, thus, when principals have weak relationships with students, the combined leadership efforts of parents, teachers, and staff can help to explain differences between high-achieving and low-achieving schools. In other words, the principal affects student achievement through the principal's influence on the actions of others (Stronge et al., 2008).

Second, schools that serve at-risk populations and experience high academic achievement tend to have strong leaders who are committed to teaching and learning. The approaches that principals use can be the difference between students receiving quality instruction, receiving inadequate instruction, or learning simply not occurring (Marzano, 2003). The *Executive Summary of the NCLB Act* states that principals have "highly complex responsibilities", therefore school leaders must possess "specific skills and strategies that guide teachers and students to achieve" (USDE, 2004, p. 61). Studies that measured principal effectiveness found that principals who were rated as successful had a commitment to teaching and learning and held high expectations for students and teachers alike (Cotton, 2003). The principal focused on effective instructional practices and "[made] decisions based on effective practices" (Cotton, 2003, p. 70).

One of the components of an effective school is a strong instructional leader (Edmonds, 1979; Lezotte, 2002). Strong principals are involved in the instructional practices of the school. Nettles and Herrington (2007) identified seven instructional behaviors that impact principals' effectiveness. These included, "making suggestions, giving feedback, modeling effective instruction, soliciting opinions, supporting collaboration, providing professional development opportunities, and giving praise for effective teaching" (Nettles & Herrington, 2007, p. 725).

Principals create and maintain a high-quality school by improving student access to effective instructional practices and requiring high expectations. In an early quantitative study of 33 schools, Andrews and Soder (1987) found that school principals played a critical role in "setting expectations for continued improvement of the instructional program and staff development" (p. 11). The researchers noted that those principals rated as strong leaders had the strongest student academic gains on mathematical state assessments. On the other hand, those principals rated as average or weak leaders had low student gains on mathematical state assessments.

Branch, Hanushek, and Rivkin (2013) related principal quality to the mathematical performance of students from 1995-2001. They were interested in whether a principal's tenure has an impact on the quality of teaching and learning in a school. The researchers found that a "principal's impact on the quality of the teaching staff increases over time as ineffective teachers are removed and effective teachers are hired" (Branch et al., 2013, p. 65). The results indicated that less-effective teachers were more likely to leave schools with strong principals and that strong principals hired effective teachers, with an increase in student achievement in most schools. As Darling-Hammond (2007) concluded, the principal is the main reason that a teacher decides to stay at a school. The principal must create and sustain a high-quality learning environment for students and teachers.

Finally, strong principals work to build a positive school climate where students, teachers, and parents feel welcome and valued. A positive school climate is one of the many factors that influence the overall success of a school (Cotton, 2003; Edmonds, 1979; Marzano, 2003). Barth (2007) argued that "a school's culture has far more influence on life and learning in a school than the state department of education, the superintendent, or even the principal" (p. 159).

The principal is responsible for a positive school culture (Habegger, 2008). The principal must convey that he or she values the expertise of the staff, which gives the staff the feeling that their opinions matter and encourages them to try new methods to enhance student achievement. For some children, a positive school climate may be the primary motivation for coming to school (Payne, 2003). Therefore, researchers indicated that "a principal can have an indirect effect on school effectiveness through actions that shape the school's climate" (Hallinger et al., 1996, p. 527).

In summary, the literature offers many insights on the role of school factors in student academic achievement. Schools must identify and implement practices that are critical to students' success, such as strong leadership, high expectations of student achievement, orderly environments, and monitoring of student achievement data (Edmonds, 1979; Lezotte & Jacoby, 1990; Murphy, 1992; Purkey & Smith, 1983). In particular, schools must be a safe place for teaching and learning, because disorder affects the overall community (Henry, 2000). Schools must implement and maintain frequent school-wide and classroom level monitoring systems to support teachers and school leaders in continuous school improvement efforts. And finally,

school leadership matters, and some researchers even suggest that a principal has a more profound influence on student achievement than any other factor (Cotton, 2003; Edmonds, 1979; Kelley & Peterson, 2007).

### **Summary**

The importance of mathematics achievement cannot be overestimated. The level of mathematics courses taken during a student's middle school experience has a domino effect on the intensity of the student's academic preparation, the quality of instruction the student receives, the high school courses the student is likely to take, and the likelihood of the student's graduation. Ultimately, the level of courses impacts college enrollment and job attainment.

Although mathematics preparation is crucial for life-long aspirations and for self-sufficiency in the world, researchers indicate that Black students are underrepresented in advanced classes (Geiser & Santelices, 2004). Adelman (1999) recommended that, if educators want to reduce disparities in student achievement, schools must improve participation in advanced level courses by Black students. While there are many factors that influence Black student access to advanced courses, schools can take purposeful steps to ensure all students have equal access to academic intensity and quality in such classes.

More research is needed on how schools can reduce the disparities in the participation rate and achievement between Black and White students in advanced math classes. Chapter 3 describes the research methodology used to examine how one middle school prepared and supported student achievement in advanced mathematics classes.

## **Chapter 3**

### **Research Methodology**

This study focused on the problem of the underrepresentation and underperformance of Black students in advanced mathematics classes in the middle school years (Adelman, 2006; Aud et al., 2010; Berry, 2005; Darity et al., 2001; Darling-Hammond, 2004; Ladson-Billings, 1997; Riegle-Crumb & Grodsky, 2010; Spielhagen, 2011; Walker, 2007). This case study examined how one middle school implemented strategies, practices, and policies to prepare and support student enrollment and achievement in advanced mathematics classes.

This chapter begins with a brief restatement of the purpose of the study and the research questions. The case study design that guides this study is then presented, including the rationale for using the approach in this study, and a discussion of the importance of the process of description and interpretation in a case study. Discussions of specific research procedures follow, including selection of the setting and participants, and the procedures for data collection, management, and analysis. Finally, procedures for ensuring the quality of the research are discussed, including strategies for ensuring that the research was conducted in an ethical fashion, reflections on the role of the researcher, and strategies for ensuring the trustworthiness of the study.

### **Purpose of the Study**

In the sixty years since the decision in *Brown v. Board of Education* (1954), some schools have made strides toward equality in education by increasing Black student achievement in mathematics, using practices and strategies that promote teaching and learning for all students (Boykin & Noguera, 2011; Darity et al., 2001; Walker, 2007). Yet, the research also shows that Black students remain underrepresented in advanced mathematics classrooms for many different reasons (Burris et al., 2004; Darling-Hammond, 2004; Ferguson, 2007). The purpose of this case study was to examine how one middle school implemented practices, strategies, and policies to prepare Black students for enrollment in advanced mathematics classes and to support their success. The ultimate goal of the study was to identify strategies for success that would be a contribution to the body of knowledge and from which other educators might learn.

## **Research Questions**

The primary research question for the study was “What were the policies, practices, and strategies that one middle school used to prepare Black students for and support Black student enrollment and achievement in advanced mathematics classes?” Three related research questions guided the data collection process and the analysis of the findings:

- What specific policies, practices, and strategies were used to encourage and sustain Black student enrollment and achievement in advanced mathematics classes at the middle school level?
- How did school and district personnel use these policies, practices, and strategies to influence Black students’ achievement in mathematics?
- What barriers impeded Black student enrollment and/or achievement in advanced mathematics classes?

## **The Case Study Design**

A case study is a qualitative research method that focuses on “an in-depth exploration of a process or event” (Creswell, 2005, p. 439) in order to provide insight into a topic of interest. Rossman and Rallis (2012) stated that qualitative research allows researchers to seek answers to their questions in a natural setting and to “gather what they see, hear, and read from people and places and from events and activities” (p. 4).

A case study helps individuals understand “processes and programs that will shed some light on an issue” (Merriam, 1998, p. 33). This design provides educators an opportunity to understand educational issues and processes by exploring a “bounded system based on extensive data collection” (Creswell, 2005, p. 439) such as interviews, document analysis, and site observations.

The purpose of this study was to examine the practices and strategies that one middle school used to increase student representation in advanced mathematics classes. Examining one middle school allowed more time to be devoted to an in-depth understanding of the topic of interest (Creswell, 2005). The interaction of significant factors that impacted the topic of study was learned from a single case study (Merriam, 1998).

## **Rationale for Case Study Design**

A case study design is especially well suited for “in-depth study of instances of [practices] in its natural context and from the perspective of the participants involved” (Gall, Gall, & Borg, 2003, p. 127). Case study researchers learn from participants and their experiences (Creswell, 2005). The researcher must capture the “participants’ experiences without any constraints and to be open to whatever emerges from the results of the study” (Patton, 2003, p. 170).

Thus, a case study approach was appropriate for an in-depth and detailed examination of one middle school’s practices and programs surrounding Black student enrollment and achievement in advanced mathematics, as well as the related activities and experiences of the administrators, math teachers, guidance counselors, and other school related personnel (Roberts, 2010; Rossman & Rallis, 2012; Seidman, 2006). Gaining an in-depth understanding of this issue involved interviewing school personnel who have lived experiences and were close to the situation of the day-to-day work of mathematics achievement. The lessons learned through this single-case study will provide insights into the “hows and whys” of Black student achievement in advanced mathematics classes.

## **Description and Interpretation**

Description and interpretation are at the heart of the case study method. The researcher seeks to provide a detailed and meaningful description and explanation of a particular phenomenon in a particular setting. The researcher in a qualitative study is the “research instrument” (Creswell, 2005). The researcher is the collector and interpreter of the data, which includes identifying the types of data that will inform the study (Creswell, 2005; Rossman & Rallis, 2012). The researcher decides, in cooperation with the research participants, what data to collect. The researcher then must make sense of that data.

Given the researcher’s role as collector and interpreter of data, the influence of the researcher on the research process must be acknowledged and managed (Merriam, 1998).

The qualitative researcher must reflect on her own personal history and how it may shape a study (Rossman & Rallis, 2012). I acknowledge that my personal and professional experiences have helped shape this study. First, I believe that children should be presented opportunities to access a challenging curriculum thus encouraging academic achievement, especially minority

children with limited means, so that they may have a chance to break cycles of poverty. Individuals who hold college degrees tend to have a competitive edge in the job market (Baum, Ma, & Payea, 2010). Just as important, the research also suggests that, “beyond posing an obstacle to college math success, being academically underprepared in math can have consequences for students and reduce the probability that they will [enroll] and complete college” (Hodara & Barton, 2014, p. 1). As I conducted this study, I had to be aware of these experiences and beliefs, and also attentive to the experiences that the participants were sharing with me, so that I was open to learning new information.

On the other hand, my background as an educator aided me in completing the case study process thoughtfully, professionally, and objectively. My experiences as an administrator at the elementary and secondary levels, teaching experience at the upper elementary level, curriculum and development experience as a Director of Instruction, and experience in working closely with staff, students, families, and extended community strengthened my working knowledge of the mathematics curriculum, the data collection and analysis process, and the processes of interviewing, questioning, and reflecting. These experiences supported this research in a thorough, professional, and meaningful way. At the end of this chapter, after discussing the processes of data collection, management, and analysis, I will return to this topic and reflect on specific steps that I took to be mindful of my potential influence.

## **Research Setting and Participants**

### **Purposive Sampling**

In qualitative research, there are a variety of approaches for selecting study participants. This study used purposeful sampling, which refers to selecting study participants “who best help us understand” (Creswell, 2005, p. 203) our topic of interest. The topic of interest was practices and strategies that one middle school used to prepare and support student enrollment in advanced mathematics classes. Since the goal of the study was to examine pertinent information about the topic of interest, the middle school selected for the case study was based on pre-determined criteria that required the use of purposeful sampling. I was interested in interviewing study participants at the participating site who had a direct or an indirect impact on enrollment and achievement in advanced mathematics classes. In this case, homogenous sampling was used because the participants possessed similar characteristics (Patton, 2002) related to mathematics:

mathematics teachers, administrators who evaluated and supported mathematics teachers, guidance counselors who provided academic advising and related services to students, and other individuals who had a direct or indirect impact on mathematics curriculums and instruction.

### **Research Site**

The setting for this study was one middle school in a Virginia school district, which housed students in Grades 6-8. To protect confidentiality, the school was given the pseudonym “Rose Middle School” and the district was given the pseudonym “Rose School District.”

The following information was obtained from the district’s website, the district and school’s Report Card found on the VDOE website, and the district’s Membership and Percentage of Attendance Report. During the time this study was conducted, Rose School District had 12 elementary schools, two middle schools, and one high school. Approximately 7,300 students were enrolled in the district schools, of which approximately 12% were Black or of mixed ancestry. Greater than 54% of the students in the district received free or reduced-price lunch. Rose School District was considered a middle to lower-class school district based on both the free or reduced-fee lunch percentages and the local unemployment rates. Recent Census statistics show that the rural community that supports Rose School District is comprised of families with varied income levels, diverse backgrounds, and varied educational levels. Half of the elementary schools in the district were considered Title I schools, which served a high percentage of at-risk children who attend school with some identified disadvantages. All of the 12 elementary schools had full-day Pre-K programs. Rose Middle School was selected as the site for this case study because it met most of the criteria established during the planning of this study:

Table 1

*Pre-established Criteria for the Study*

<b>Pre-established Criteria</b>	<b>Participating Middle School</b>
School is a Grades 6-8 middle school located in a southern state.	Yes
School has a student population between 400 and 1600.	Approximately 1,600 students in this middle school and Approximately 7,500 in the division.
School has at least 50 or more Black students within each grade level. The reason for this criterion is that districts are not required to report results of state testing with subgroups smaller than 50.	2012-2013  Grade 6 – 579 total population/ 63 Black students  Grade 7 – 570 total population/ 59 Black students  Grade 8 – 541 total population/ 69 Black students
School has full accreditation based on the relevant state requirements.	The school division’s report card located on the VDOE website indicated that the school is fully accredited.
School has highly qualified teachers as defined in the Elementary and Secondary Education Act (NCLB, 2001). Therefore, the school will have no more than one teacher who is teaching out of his or her content area.	All teachers held an endorsement in the areas for which they taught. All but one special education teacher was highly qualified (School Report Card, VDOE, 2013).
Students at the school have access to and the opportunity to take honors and advanced classes.	The school offered honors, high level, average mathematics classes; Pre-Algebra and Algebra classes (enrollment based on criteria).
School Report Card indicated that Black students are taking standardized tests such as Algebra I which evidences students are enrolled in advanced mathematics classes at the middle school level.	Black students were enrolled in honors and high level mathematics classes (2013 Class Enrollment & Ethnicity Report).

As shown, this middle school met the pre-established criteria. The Black population is not as large as desired, but the population was sufficient to observe the topic of interest.

Based on the 2013 Membership and Percentage of Attendance report (D16), Rose Middle School served approximately 1,600 students in a typical Grades 6-8 middle school design. There were approximately 560 students in each grade level. The ethnicity of the students was as follows: 72% White, 12% Black, 4% Asian, 6% Hispanic, and 4% identified as Other

Designation. Rose Middle School had 50 or more Black students in each grade level. The Students with Disabilities population, including students with IEPs and 504s, was approximately 16%. The identified Gifted and Talented population was approximately 6%. Approximately 53% of the students in this school were eligible for free or reduced-price lunches. The mobility rate was approximately 6% based on the school's enrollment data trends during the course of 2012-13.

The school was fully accredited by the Virginia Department of Education. Current accreditation pass rates based on 2013-2014 state assessments show combined data averages for Grades 6-8 were as follows: English 75%, History 90%, Mathematics 85%, and Science 85%. The school had highly qualified teachers as defined in the Elementary and Secondary Education Act (NCLB, 2001). The school had no teachers who were teaching out of their content areas. The school had a staff of 6 administrators, 1 mathematics specialist (who also teaches math classes), 5 guidance counselors, 110 teachers, and 12 paraprofessionals.

Based on the 2013 master schedule (D17) and 2013 course guide (D1), Rose Middle School offered a variety of mathematics classes at varied levels, as shown in Table 2.

Table 2

*Rose Middle School Course Offerings 2013-2014<sup>1</sup>*

Math Course	Prerequisite(s)	Course in Next Grade
Math 6	Successful completion of Math 5	Math 7
Honors Math 6	Criteria determination include: 5 <sup>th</sup> grade teacher recommendation; 4 <sup>th</sup> & 5 <sup>th</sup> grade Math SOL scores; achieving a score of 19-25 on teacher-made rubric	Honors Math 7
Math 7	Successful completion of Math 6	Pre-Algebra 8 or Pre-AP Honors Algebra I for qualifying students
Honors Math 7	Criteria determination include: successful completion of Honors Math 6, teacher recommendation, Math 6 SOL score; achieving a score of 19-25 or higher on rubric	Pre-AP Honors Algebra I
Pre-Algebra 8	Successful completion of Math 7	Algebra I at high school
Pre-AP Honors Algebra	Criteria determination include: teacher recommendation, successful completion of Math 7; course grade & score on Algebra Readiness Test (Orleans Hanna assessment)	Geometry or Honors Geometry at high school

The goal of this case study is to “shed light on or offer insights about” (Rossman & Rallis, 2012, p. 104) procedures, practices, and strategies to support mathematics achievement at the middle school level. In fact, the case study design is a particularly useful approach for studying how one middle school prepared and supported Black students in advanced level mathematics classes (Merriam, 1998; Yin, 2009).

### **Gaining Access through Gatekeepers**

Before beginning the study, I completed an Institutional Review Board [IRB] Research application and was granted approval on April 24, 2014. Upon approval, I arranged access to

<sup>1</sup> Information retrieved from Rose Middle School Course Guide 2013-2104

Rose Middle School by working through “gatekeepers.” Creswell (2005) defines a gatekeeper as someone who has a role at the site of interest and can help to locate participants for the study.

First, I spoke with the Superintendent of the district about the study via telephone. During the initial interactions with the Superintendent, I provided full information about the study such as:

Why the division and specific school was chosen,

What was the timeframe of the study,

What, if any, potential for disruptions to the learning environment existed, and

What was the benefit to the school for participating in the study?

(Creswell, 2005, p. 209)

I allowed the Superintendent to ask clarifying questions (Creswell, 2005) and answered those questions in an honest and nonthreatening manner. I assured him that I would do no harm in regards to promoting situations where the participants would question the organization. I also promised that there would be no disruption to the school environment. After this discussion, the Superintendent gave me permission to proceed further.

Thereafter, I contacted the Rose Middle School Principal to gain permission to conduct the study. I spoke with the Principal about the study and potential individuals to interview. The Principal gave me permission to proceed and suggested names of individuals that I might contact.

### **Participants**

Once the approval of the Superintendent and Principal were secured, I identified individual participants for the study. Individuals were sought from within Rose Middle School and outside of Rose Middle School. Within Rose Middle School, the individuals who were invited to participate in this study possessed teaching or administrative endorsements, were highly qualified as defined under NCLB, and had direct or indirect impact on course selection, academic advising, and/or mathematics achievement in the participating school.

Demographics (experience, race, and gender) of the study participants were as follows. The years of experience ranged from seven to thirty-two years. Of the thirteen study participants, five were Black, nine were White, four were males, and nine were females. The individuals who agreed to participate in this study consisted of six math teachers, one math consultant, three

guidance counselors, and three site or district administrators. The mathematics teachers and guidance counselors were selected to ensure representation from Grades 6-8. Outside of Rose Middle School, district office personnel and a UVA math consultant were invited to participate in the study, individuals who had a direct or indirect impact on enrollment policies and procedures, course selection, curriculum and assessment alignment, and on mathematics achievement. These individuals were positioned to be informative on the research questions.

I used the following process to gain the consent of these individuals to participate in the study. Potential study participants were identified based on their relationship to Grades 6-8 mathematics courses or through a recommendation from the campus principal. After generating a list of study participants to contact, I emailed each potential participant and explained the study, requested an interview, explained why they were chosen to participate in the study, described the length of the interview, and gave confidentiality information. Most potential study participants replied yes to the request. Once the participants accepted the invitation, interviews were scheduled. I emailed each participant the dissertation proposal, Virginia Tech's Approval form, the Consent Form (see Appendix D), the interview instrument (see Appendix M, Appendix N, and Appendix O), and confirmation of the meeting.

### **Data Collection Procedures**

The researcher gathers the data necessary to present the reader with "salient themes, recurring language, and patterns of beliefs" (Anfara, Brown, & Mangione, 2002, p. 31). In educational research, a case study often incorporates the use of direct observations of events within the natural setting (classrooms, overall school environment, teacher meetings, and curriculum development), in-depth interviews of school personnel, and a review of written documents and artifacts (Merriam, 1998; Roberts, 2010; Rossman & Rallis, 2012; Seidman, 2006). These strategies were used in this study, guided by key factors that were identified in the literature (see Chapter 2) and from the conceptual framework of Bryk et al. (2010).

Data collection took place during the months of April, May, and June 2014. Three primary methods were used: (a) one-on-one interviews with school personnel (administrators, guidance counselors, and math teachers) and others who may have had a direct or indirect impact on student achievement (school board personnel, and math consultant); (b) observations of events in the middle school; and (c) a review of documents to help triangulate the findings from

observation and interviews (See Table 3). Each data collection process is discussed separately in the sections that follow.

Table 3  
*Data Sources for the Study*<sup>2</sup>

Interviews	Observations	Documents
Administrators (3)	Classroom Observations	Grade Level Math Meetings
Math Teachers (6)	Faculty Meetings	Course Guides
Guidance Counselors (3)	Mathematics Curriculum	Faculty Meeting Agendas
Math Consultant (1)	Development Meeting	Registration Timelines
		SOL Scores
		VDOE Site Report Card
		Master Schedules
		Class Rosters
		Student Handbook
		School Website

### Interviews

Researchers use interviews as a way to collect qualitative data to understand “lived experiences of people and the meaning they make of those experiences” (Seidman, 2006, p. 9) about a topic of interest. Interviews were important for this case study because they were the best way to investigate the participating school’s experiences of carrying out the process of increasing students’ mathematics achievement through changes in procedures, processes, and practices. The interview process included designed interview questions that captured the study participants’ experiences about the process. Patton (2002) asserted that “the best way to guard against variations among interviewers is to carefully word questions in advance...how a question

<sup>2</sup> Data sources were from study participants’ interviews, school level observations, and document analysis.

is worded and asked affects how the interviewee responds” (p. 351). Using the literature review and Bryk et al’s., (2010) conceptual framework, questions were designed to “capture the complexities of the [participants’] perceptions, experiences” and also took care “to ensure [the questions] were open-ended, neutral, singular, and clear” (Patton, 2002, p. 348) (see Appendix M, Appendix N, & Appendix O). I drafted these semi-structured interview guides to ensure that each participant in the research experienced the same general line of questioning. Semi-structured interviews are defined as interviews that include both closed- and open-ended questions (Creswell, 2005).

I conducted 13 one-on-one semi-structured interviews with administrators, math teachers, math specialist, math consultant, and guidance counselors, who had a direct or indirect impact on mathematics achievement, during the months of April, May, and June 2014 at various locations. The interviews were conducted before school, during planning periods, after school, and at other times that were convenient for participants. Each participant was interviewed only once for 30-50 minutes. Before the interviews began, I reviewed the Consent Form with each participant (See Appendix D). Participants were fully informed about the interview process so that they could decide whether or not they wanted to participate in the interview. I assured participants that their identity would remain confidential and that they were able to withdraw from the study at any time. I also explained that the interview would be digitally recorded for transcription purposes and to ensure that their experiences and ideas were presented accurately. The participant’s questions were answered. Each participant then initialed and signed the Consent Form.

The participants were asked between 10-15 questions. Questions were organized categorically in the protocol instruments, but, at times, the order of the questions was changed or questions were omitted to improve the conversational flow. When appropriate, follow-up questions were asked to gather additional information related to other factors potentially associated with practices that impacted Black student mathematics achievement (Creswell, 2005; Patton, 2001).

I took notes in a notebook during each interview to help facilitate the interview and to use later when analyzing the data for themes that emerged during the interview process. The notes also helped with updating the audit trail of the study’s progression. The interviews were also recorded for later reference and analysis.

The interviews were transcribed by a transcriptionist and me. Due to the nature of the time involved, I felt the aid of a transcriber would support a faster turnaround time for member checks and analysis of the data. Even though some of the interviews took place when school was in session during the month of May and until the latter part of June, the majority of the transcribing occurred during the months of June and July. All transcripts were sent to the interviewees, who were invited to review them for accuracy of the data and for feedback.

Most participants did not provide any formal feedback beyond acknowledging that the transcripts were accurate as typed. Some noted wording corrections. For those participants who did not respond when transcripts were first returned, I sent another email with a reminder that the transcripts were sent and again asked for feedback. The time-span in returning the transcripts may have played a role in the limited feedback received. The transcripts that were returned to the participants within a month to two months yielded limited feedback, only that the information was accurate. The interview questions were evaluated via content validity check and pilot testing.

**Content validity check.** A content validity check is the process of making sure the questions on the interview protocol are representative of all possible questions that could be asked (Creswell, 2005) and a step in improving the questions that will be asked. The questions developed for the interview protocol were evaluated using a content validity check to determine (a) the degree to which the content of the question matched the related study topic, and (b) the clarity of the question.

To conduct the content validity check for this study, I asked four administrators, three guidance counselors, and four teachers to participate in a review of the protocol questions. The panel was composed of educators from middle schools in school districts other than Rose, from educators in my district, and from individuals in my educational leadership cohort. After each panel member agreed to participate in the review, I emailed all panel members the content validity instruments and asked them to determine if the questions were aligned with the study topic, need rewording, or if a question should be deleted (see Appendix Q). The individuals were given a rating scale and asked to rate each item by placing 1 (unclear, delete), 2 (somewhat clear, need rewording), or 3 (clear, leave as it) beside each question in order to indicate the clarity of the question.

The majority of the suggestions were received within two to three days after sending the instrument to the panel members. As the instruments were returned, suggested revisions were made where appropriate. All necessary changes were made to the interview questions (protocol) for rewording, clarity, or deletions, before the interviews began. Hard copies of the responses were printed and are maintained in a notebook in a locked file cabinet with other study instruments.

**Pilot testing.** A pilot test of the interview questions was conducted with two administrators, two teachers, and two guidance counselors. Participants for the pilot test had completed at least one year of experience in their current position as an administrator, a teacher, or guidance counselor. The administrators facilitated and evaluated instruction in advanced mathematics classes. The teachers were classroom mathematics teachers in Grades 6-8 who have at least one year of teaching experience. The guidance counselors assisted with the provision of educational and related services to students and teachers, including helping parents and students with course selections. People who agreed to participate in the pilot study were emailed requesting a day and time to conduct the interview. Thereafter an email was sent to confirm the interview along with the Informed Consent to Participate form and interview questions. Prior to the interview, each participant signed the Informed Consent to Participate form and was able to ask any clarifying questions about the study or interview. The pilot study interviews were transcribed and emailed back to the participants to determine accuracy and to give the participants an opportunity to provide any feedback. Information from the pilot test was used to revise interview questions. For example, one participant suggested a question from the administrator's interview instrument be deleted. Even though I conducted the content validity check, the pilot test helped to produce a stronger data collection instrument and sharpen interview skills. For example, listening to and transcribing some of the pilot study participants' interviews made me realize that I added comments during the interviews, which more than likely influenced the interviewees' thought processes and responses to the questions. Thereafter, when conducting interviews I worked to stay focused on the interviewees' experiences so that the data collected were their experiences and insights.

## **Observations**

Data collection in the school setting is important because the researcher is most likely to observe activities that support mathematics achievement and gather additional data about the topic of interest (Maykut & Morehouse, 1994). I observed delivery of instruction, related activities, and school environment actions and interactions that provided triangulation for the study. I observed mathematics classrooms, faculty meetings, mathematics curriculum development sessions, and grade level math meetings. Through observation, I documented any processes or interactions that supported mathematics achievement. For example, during one curriculum development session, the teachers were revising pacing guides and curriculum to integrate performance tasks in each unit of study; they were also developing resources that the math tutors could use that aligned with units of study. During a faculty meeting, the principal asked teacher leaders to present instructional strategies that integrated high level questioning.

My observations were guided by an observation protocol sheet (see Appendix J). The 20-30 minute classroom observations were conducted without interaction with staff or students, unless the teacher or students initiated a conversation, which happened on several occasions. I tried to minimize the conversations, but felt compelled to interact since I wanted to maintain rapport with the teachers and students. I noted if the students had exposure to process standards and the delivery of instruction which, the literature indicated, seemed to be the gateway to advanced mathematics classes (Seeley, 2005). Also I noted attention to other details that supported the study (Creswell, 2005). I documented observations through field notes and notes on paper then transferred information to the audit trail for future reference. Field notes were taken during classroom observations, administrators' meetings, and mathematics curriculum development. The notes were reviewed for relevancy to practices and strategies that supported mathematics achievement, and the information was added to the audit trail for future use.

## **Documents and Other Artifacts**

Documents can “provide details to corroborate information from other sources” (Yin, 2009, p. 103). Documents were gathered and identified to develop a deeper understanding of the research topic. The primary documents for the study were course-guides, registration times, school and district report cards, staff development and faculty meeting agendas, enrollment criteria, and class rosters. The document analysis was vital to establishing a timeline of

procedures and enrollment changes over a period of time. The documents also helped to establish Black student enrollment in honors and advanced classes. Documents or other information used to support the study were collected from school guidance counselors, school website, and staff members.

### **Data Management Procedures**

Researchers have suggested that organizing data is crucial, since the research process can yield large amounts of information (Creswell, 2005). Data management requires a system, which may employ such organizing devices as file folders, index cards, or computer files (Creswell, 2005; Patton, 2001; Roberts, 2010).

Prior to collecting data for this study, a system to manage the data was developed (Creswell, 2005). A “raw data matrix” was created using a table in Word to document and organize data by source. Field notes were kept in a journal, with dates and times of observations, to document important features such as who, what, when, and where, deep descriptions, and personal reflections. Notebooks with organizers were created to maintain and store the audit trail, raw data matrix, transcribed interviews, signed consent forms, observation forms and notes, and school related documents with any identifying information. Participants and school related documents were assigned identifying codes (such as “A1” for administrators, “T1” for teacher, “GC1” for guidance counselor, “MC1” for mathematics consultant, and “D1” for documents) in order to preserve the confidentiality of the participants in the study and the school site. The documents were filed in notebooks and organized by themes, such as grade level information, school demographic data, master schedules, school improvement plans, school policies, school communication, and teacher planning periods. All documents and data were kept in a locked file cabinet for security and confidentiality purposes.

### **Data Analysis Procedures**

A case study is shaped by the collection of data and the analysis of those data (Merriam, 1998). The researcher works with the collection of data in order to “analyze and explain it to come up with answers to research questions” (Creswell, 2005, p. 588). Data were analyzed for descriptive purposes by looking at all data collected through the lens of the research questions. Description relies heavily on the voices of the participants. Then, data were also analyzed in

order to develop an explanation of why these strategies worked, from the researcher's point of view.

### **Constant Comparative Analysis**

Constant comparative analysis was the analytic process used for moving from description to explanation. It served as the foundation for defining larger categories of “meaning from the words and actions of the [potential] participants, framed from [my] focus of inquiry” (Maykut & Morehouse, 2003, p. 128). As far back as 1967, Glaser and Strauss developed constant comparative analysis to “aid the researcher in identifying patterns, coding data, and categorizing finding” (as cited in Merriam, 1998, p. 159). Thus, the constant comparative analysis method enabled me to analyze the data, in order to identify themes and categories that emerge from the data, and to draw connections among the relevant themes and categories (Maykut & Morehouse, 2003). Theory building occurs when the researcher “develop[s] a conceptual link between and among categories and properties” (Merriam, 1998, p. 159).

The constant comparative analysis process provided me with a manageable way of studying hundreds of pages of data. The following sections present how these processes were employed for the interview data, and then for the analysis of the data obtained from observations, documents, and artifacts.

### **Interview Data**

From the interview data, I obtained the insights and experiences of the participants in their own words. As discussed above, the interviews were recorded and transcribed. After each interview was transcribed, I reviewed the transcriptions multiple times. I first looked for specific answers to the research questions as provided by the participants. In addition, each transcript was reviewed to identify categories, themes, and patterns, and coded accordingly.

The constant comparative analysis process for the interviews was as follows:

1. An initial reading of the transcripts was conducted to look for actions, activities, opinions, concepts, differences, and processes relevant to the guiding research questions.
  - a. Transcripts were read line by line, highlighting key words, phrases, sentences, or sections.

- b. Key words, phrases, sentences, or sections were selected according to the following criteria:
    - i. Phrases or patterns that appeared repeatedly in the transcripts.
    - ii. The interviewee or researcher identified something as *important*.
    - iii. The information was unexpected.
    - iv. The information related to the theories, concepts, or findings from the literature review.
  - c. Coding notes were made in the right hand margin of the transcript.
2. I read the transcripts a second and third time to identify any additional coding.
  3. Upon completion of the initial coding process, I constructed a “raw data matrix.” This consisted of a table with three columns: the first column listed the participant’s identifying code; the second column listed key phrases, sentences, or words; and the third column listed the theme. A separate table was constructed for each research question.
  4. The themes from the matrices were cut and taped to index cards.
  5. The index cards containing the themes were sorted into categories.
  6. Categories were created by grouping similar themes together. For example, barriers were grouped together then subdivided based on student level, school level, or miscellaneous barriers. School level barriers were subdivided based on recurring themes, such as time, scheduling, school size, teacher preparation, and enrollment practices that were used to create categories.
  7. A miscellaneous category was created for themes that did not seem to fit a category.
  8. The themes in the miscellaneous category were examined a third time for possible inclusion in a category or the suggestion of a new category. For example, the theme of “school size” was initially placed in the miscellaneous category but after further examination, the theme was added to environmental factors under perceived barriers.
  9. The themes (and corresponding data) were compared within and between categories, and notes were made in a notebook or in the audit trail about how the categories related to the research question and to each other.

## **Observations, Documents, and Other Artifacts**

The constant comparative analysis process as described above was also used to make sense of the observations, field notes, documents, and artifacts that I gathered. These items, too, were added to the “raw data matrix,” coded for themes, and sorted into categories. The information obtained from these items was also merged with the categories from the interview data to help answer the research questions. The specific steps taken were as follows:

1. Each document was coded as D1, D2, etc.
2. Classroom observation notes were coded as CO1, CO2, etc.
3. Information in the documents and notes was reviewed for relevance to the developing themes and the research question.
4. The relevant information from each document was added to the raw data matrix with the document code, relevant information, and theme.
5. The document analysis data were merged with the interview data.
6. The process of identifying categories and sorting information into categories, described above, was continued.

## **Ensuring the Quality of the Research**

### **Ethical Considerations**

I obtained permission to conduct the study from the Virginia Tech Institutional Review Board [IRB]. I provided the participating school division and all study participants with a copy of the certificate from the IRB showing approval of the study.

**Confidentiality.** I took the necessary steps to protect the confidentiality of the research participants. I kept the identities of the school division, participating middle school, and individual participants confidential by assigning fictitious names or codes. For example, study participants were identified with codes such as A1, T1, GC2, CO1, and so on. A full explanation was given to the participants. I answered any questions they had about the study and about confidentiality. All participants signed an Informed Consent Form (see Appendix D) before the data collection began.

**Voluntary and informed consent.** I explained to the participants that participation in the study was voluntary and that they could withdraw from the study at any time. I fully

explained the nature of the study to the participants, and I answered all questions that they had. I provided the participants with copies of the consent documents with their signatures.

### **The Role of the Researcher and Managing Possible Bias**

The researcher is the “research instrument” in qualitative studies (Creswell, 2005). This means that the influence of the researcher on the research process must be acknowledged and managed (Merriam, 1998). As mentioned earlier in this chapter, my personal and professional experiences and beliefs have helped to shape and support this study in a meaningful and professional manner. Most importantly, I had to be aware of possible biases in the study and take steps to manage those possibilities. In this section, I discuss the steps that I took to manage my influence on the study and possible sources of bias.

Before I entered the research site, I took steps to consider and minimize my influence on the data gathering process. I conducted a Content Validity Check on the interview questions to ensure that I was asking appropriate questions and a pilot study, as discussed above, to help clarify questions and eliminate any questions that did not gather the data needed to answer the research questions. The pilot study also helped to detect any interviewing skills that needed sharpening, such as not adding afterthoughts to participants’ thoughts and remembering participants’ responses in order to ask relevant follow-up questions. I learned to write down key words or phrases during the interviews to help with flow of conversations, focus on what was said, and craft follow-up questions.

Once I was ready to enter the site as a researcher and had approval from the IRB, the school Superintendent, and site Principal, I took specific steps to foster a successful study (Patton, 2002). It was very important that I was a good communicator, which included establishing rapport as a researcher, helping participants who were willing to participate but apprehensive about the process, being nonjudgmental, understanding body language and facial expressions that indicated the participants’ comfort level, asking follow-up questions, and being sensitive to individuals (Creswell, 2005; Patton, 2002; Rossman & Rallis, 2012). While gathering data, I made sure that the participants understood that I was conducting the study to learn from them and from their experiences (Creswell, 2005). I also explained that once the interviews were transcribed, he or she would receive a copy of the transcriptions for his or her review to make sure their thoughts and experiences were accurately transcribed. Many asked

what I hoped to gather from the study. I explained that my hope was that the results of the study will help inform other schools, practitioners, educators, scholars, policymakers and me about ways to design systems to prepare and support student access to advanced mathematics classes.

### **Trustworthiness of the Study**

The standards for assessing the quality of qualitative research are important when it comes to validity, reliability, and credibility (Anfara et al., 2002). The goal is to develop a trustworthy study. Trustworthiness refers to the extent to which the conclusions make sense and are an accurate representation of the data collected (McMillan & Wergin, 2010).

I was aware of and worked hard to manage the potential influence of biases, in the data analysis process, as well, because I did not desire the biases to impact ways in which I made sense of the data (McMillan & Wergin, 2010). My goal was to capture the participants' experiences without any constraints so I could be "open to whatever emerged from the results of the study" (Patton, 2003, p. 170). For example, my experiences may have led me to have some strong opinions about good instructional practices and parental influence on student achievement. Therefore, I gained the support of a peer auditor who I selected for the evaluation of the study. The peer auditor will be discussed later in this chapter under the External audit section.

Creswell (2005) recommends that the researcher engage in validating the findings through procedures such as member check, triangulation, auditing, or thick descriptions in order to create a sense of trustworthiness. In this study, triangulation, member checks, external auditing, and an audit trail were used as strategies for establishing trustworthiness.

**Triangulation.** Triangulation refers to using different data sources that result in supporting evidence that help in understanding a research problem (McMillan & Wergin, 2010; Yin, 2009). Triangulation ensured that the study was accurate because "the information was not drawn from a single source, individual, or process" (Creswell, 2005, p. 252) but from multiple sources. Following these recommendations, data were collected from interviews, documents, and observations, and multiple participants, which provided for triangulation. I also added interviews with individuals who were outside of Rose Middle School in order to triangulate the information provided by those within the school.

**Member checks.** Member checks were important for presenting reliable and accurate information about the participants' experiences. Member checking occurred when the interview participants were asked to check the accuracy of the interview transcripts (Creswell, 2005; McMillan & Wergin, 2010). After the interviews were transcribed, the transcriptions were submitted to participants to ensure that they were transcribed accurately (Creswell, 2005). Feedback, even though limited, from participants was used to make additions and changes to provide an accurate presentation of the findings. An additional member check occurred when one of the study participants was asked to review the findings and interpretations from the data. The study participants gave feedback and the feedback was taken into account.

**External audit (peer auditor).** As a third measure for validating the study, an individual outside of the study who holds a Ph.D. and J.D. was asked to conduct a thorough review of the study and to report the strengths and weaknesses of the study (Creswell, 2005) while checking for biases. This process is called an external audit. The peer auditor was used to provide an external audit who gave crucial feedback that helped with the reporting and clarity of the study. The peer auditor reviewed the document three times as chapters 4 and 5 were completed. After making the suggested revisions in both chapters, I resubmitted the dissertation draft to the peer auditor for additional feedback.

**Audit trail.** Finally, a step-by-step audit trail was maintained throughout the research process to record how and when specific decisions were made and steps were performed (Creswell, 2005). The audit trail included, but was not limited to, the research process, schedules, transcription notes, agenda, field journal notes, notes about interview question revisions and pilot study, interviews notes, reflections about observations, reflections about progress of the study, coding, and building conceptual categories. The audit trail increased the likelihood that the study could be replicated if another researcher decided to duplicate the study.

In summary, the trustworthiness of this research study was enhanced by a detailed and transparent explanation of the participant selection process, data collection process, and data analysis process. Multiple data sources (interviews, documents, and observations) offered triangulation. Other strategies, such as an audit trail for potential replication purposes, member checks to confirm accuracy of the interviews, and a peer auditor who offered feedback as the study progressed, helped to ensure that the findings were trustworthy.

## Summary

This study was designed to examine the practices, policies, and strategies that one middle school used to prepare and support student achievement, especially Black student achievement, in advanced mathematics classes. This chapter began with a restatement of the purpose of the research, the primary research questions, and related sub-questions. The case study framework that guided this study was then presented, including the rationale for using the approach, and a discussion of the importance of the process of description and interpretation in a case study. Discussions of specific research procedures followed, including selection of the setting and participants, and the procedures used for data collection, management, and analysis. Finally, procedures for ensuring the quality of the research were discussed, including strategies for ensuring that the research was conducted in an ethical fashion, reflections on the role of the researcher and possible biases, and strategies for ensuring the trustworthiness of the study.

In the next chapter, the research findings are presented. The careful design of this case study yielded research insights that will provide educators, practitioners, and policymakers a broader understanding of the factors and practices that prepare and support student achievement in advanced mathematics classes.

## **Chapter 4**

### **Findings**

The purpose of this case study was to examine how one middle school implemented practices, strategies, and policies to prepare Black students for enrollment in advanced mathematics classes and to support their success. The ultimate goal of the study was to identify practices and strategies for success that would contribute to the body of knowledge on Black student achievement, specifically mathematics achievement, from which other educators might learn.

The primary research question for the study was “What were the policies, practices, and strategies that one middle school used to prepare Black students for and support Black student enrollment and achievement in advanced mathematics classes?” Three related research questions guided the data collection process and the analysis of the findings:

- What specific policies, practices, and strategies were used to encourage and sustain Black student enrollment and achievement in advanced mathematics classes at the middle school level?
- How did school and district personnel use these policies, practices, and strategies to influence Black students’ achievement in advanced mathematics?
- What barriers impeded Black student enrollment and/or achievement in advanced mathematics classes?

This chapter presents the findings, including insights across the three forms of data collected: interviews, observations, and documents and artifacts. Analysis was conducted using the conceptual framework introduced in Chapter 1. Bryk et al. (2010) argued that effective schools possess certain characteristics that support mathematics achievement, such as (a) strong school leadership, (b) professional capacity, (c) instructional guidance, (d) student-centered learning, and (e) parent-community ties. The framework offered by Bryk et al. (2010) captured the relevant practices, strategies, and barriers that appeared across the research (Darling-Hammond, 2004; NCTM, 2008; Reeves, 2003; Walker, 2007; Waters, Marzano, & McNulty, 2003). Together, these practices, strategies, and barriers offered a framework for organizing and analyzing the data in this study.

As noted in Chapter 3, categories were built by grouping recurring themes into overarching subjects that tied them together. Through the data analysis process, six major categories emerged that were relevant to the research questions:

- Mathematics Placement Innovations
- Cultural Shift towards Increased Rigor
- Culture of High Expectations
- Culture of Continuous Learning
- Data Sharing
- Perceived Barriers to Enrollment

Data were further organized into themes that were relevant to each category. These six categories and the related themes for each are summarized in Table 4.

Table 4

*Categories and Attendant Themes*

---

- (a) Mathematics Placement Innovations
    - Change Management Process
    - Changes in Enrollment Criteria
    - Communication Resources for Enrollment Criteria and Procedures
  
  - (b) Cultural Shift towards Increased Rigor
    - District and School Expectations and Practices
    - Role of School Leadership
    - Visibility
  
  - (c) Culture of High Expectations
    - School-wide Expectations
    - Student-Teacher Relationships
    - Assumptions about Black Students in Advanced Classes
  
  - (d) Culture of Continuous Learning
    - Administrators' Professional Development
    - Teachers' Professional Development
  
  - (e) Data Sharing
    - School-wide Practices
    - Remediation and Extension Activities
  
  - (f) Perceived Barriers to Enrollment
    - Communication
    - School Practices
    - Teacher Preparation (Expectations)
    - Cultural Beliefs
- 

The findings presented here suggest that Rose Middle School made a commitment to increase students' mathematics skills, which in turn impacted student access, especially for Black students, to advanced classes. This culture of commitment extended to district staff, school administrators, teachers, and other staff who made a joint effort to implement practices and strategies that increased student enrollment and achievement advanced mathematics classes. The data also provided a lens that helped to make sense of the interwoven barriers that, at times, hindered enrollment and success for all students, and especially for Black students, in advanced mathematics classes. Before the findings are presented, the following is a recap of the school's demographics. Rose Middle School served Grades 6-8 in a typical middle school design with

approximately 550 students in each grade level. The demographics of the student population included 72% White, 12% Black, 4% Asian, 6% Hispanic, and 4% identified as Other Designation. There were 50 or more Blacks in each grade level. The identified gifted and talented population was approximately 6% and the students with disabilities population was approximately 16%. Free or reduced-lunches eligibility was approximately 53%. During the time of this study, the school's Report Card indicated that the school was fully accredited. Rose Middle School had a staff of 6 administrators, 1 mathematics specialist (who also teaches math classes), 5 guidance counselors, 110 general and special education teachers, and 12 paraprofessionals.

Chapter 4 is organized according to the six categories and related themes that are identified in Table 4. Examples from responses to interview questions, the site observations, and a review of documents and artifacts are included in order to paint a picture of Rose Middle School and what was happening at the site related to the research questions. The sources of the data are identified with the following notations, for example, (A8, 7-1) indicates Administrator 8 was interviewed on July 1; (T1, 4-28) indicates Teacher 8 was interviewed on April 28; (MC1, 6-30) indicates Mathematics Consultant 1 was interviewed on June 30; (D1) indicates Document 1; and (CO1) indicates Classroom Observation 1. This particular coding was used to ensure the confidentiality of the interview participants, documents, and classroom observations. The first section of this chapter presents the findings from the data that address the first and second research questions, "what were the policies, practices, and strategies and how did school and district personnel use these to influence Black students' achievement in advanced mathematics?" The final section of Chapter 4 addresses the third research question, "what barriers impeded Black student enrollment and/or achievement in advanced mathematics classes?"

### **Mathematics Placement Innovations**

Change and innovation were important themes in the data. Over the course of the last four years, eligibility considerations for advanced classes have changed at Rose Middle School. The change process required a course of action grounded in goals, reinforced with practices that supported mathematics achievement, and measured by growth in both advanced mathematics classes and student access to a rigorous curriculum. It took a concerted change management effort in order to achieve the changes that occurred at Rose Middle School during the past four

years. The changes made advanced level classes accessible to more eligible students, which had an effect on Black students.

Interview responses and document analysis indicated that there were three primary factors that fostered a culture of change around mathematics placement. First, the district wanted to meet federal and state benchmarks (VDOE, 2013). Second, the district and the school needed to align curriculum and instruction to meet the rigorous standards adopted by the Virginia Department of Education in 2009, which, in turn, would provide students with the mathematics foundations necessary to achieve in challenging mathematics classes (VDOE, 2013). Third, as part of this alignment, mathematics placement criteria were changed, which provided more students access to advanced mathematics classes. Therefore, the district led the initiative to change its enrollment criteria to enroll students in honors mathematics classes and to revise Grades 6-8 mathematics curricula to align with rigorous state standards. Two factors in the data, in particular, were closely related to school-level innovations in mathematics placement: a change management process that affected enrollment criteria and the actual changes made to the enrollment criteria.

### **Change Management Process**

District and school leaders initiated the local changes. However, the catalyst that motivated those leaders came from the revision of the mathematics standards from the Virginia Department of Education (VDOE). The review of interview data and state mathematics standards for Grades 6-8 indicated that the state revised the mathematics standards in Grades Pre-K-12 to include more process standards. The data indicate that changes at the school level occurred because of federal, state, and local influence. The VDOE revised the standards and expected each district to implement the changes. In turn, the district partnered with the local schools to implement the changes. One of the district leaders (A3, 4-29) summarized the net effect in his interview, “The rigorous changes in state standards have allowed us to change practices, revise curriculum, and provide staff development to support such changes.”

The establishment of enrollment criteria based on state assessment data was generally seen as a positive change that led to a change in eligibility. The changes in enrollment criteria have resulted in all students having increased access to advanced mathematics classes at Rose Middle School, which, of course, included Black students. Within the last three years, honors

classes in Grades 6-8 have seen an increase in enrollment numbers for all students, and also for Black students, due to these changes. A full discussion of those data will follow below.

The data also showed that the path to mathematics achievement in middle school begins with decisions and recommendations that are made prior to students entering middle school. One study participant highlighted the importance of instituting changes further back in the educational pipeline (A2, 4-28):

As a division we're in the early stages of modifying instructional strategies to make students successful on new types of assessments. There are several terms you can attach to that... performance tasks, authentic assessments, getting students to be able to think...work through problems...solving problems instead of just plugging numbers into equations. That's the step we're trying to take right now in the division. It's a K-12 initiative where kindergarten teachers are developing performance tasks; they're starting to talk to their students about being problem solvers and thinkers so they can analyze a problem and design a way to get to the final answer and it's not necessarily an algorithm.

Although revised state standards spearheaded the changes that the district and schools experienced, change is a process over time that must be managed. The data show that changes were implemented at Rose Middle School in order to improve mathematics achievement, which then resulted in reshaping enrollment processes and systems of support.

### **Changes in Enrollment Criteria**

**Historical enrollment practices.** The path to advanced mathematics classes in middle school begins with decisions and recommendations that are made prior to the students entering sixth grade. Prior to the revisions in enrollment criteria, students in the Rose School District were tracked into mathematics programs as early as the 5<sup>th</sup> grade. A review of course guides (D1) indicated that students in Grade 5 who were interested in taking honors mathematics classes in Grade 6 would take the Tomags (Test of Mathematical Ability for Gifted Students) assessment to determine their eligibility. This criterion was the only factor used to determine eligibility, which was a cause for concern. As participant T4 (6-4) indicated, "...having more than one criterion is much better than just having the one criterion. Either students were in or out, even though I liked the norm-referenced criterion."

A fifth grade teacher recommendation was the catalyst to take the Tomags. A study of class rosters in Grade 6 (D16) between 2010-2012 revealed that this process yielded 25-30 students who automatically entered Pre-Algebra in Grade 6. As one study participant (T6, 6-10) explained:

... as far back as the mid-2000s, in order for students to have the opportunity to be considered for an advanced mathematics class at the middle school level, 5<sup>th</sup> grade teachers and elementary principals would recommend students for advanced mathematics at the sixth grade level. They [students] would take the Tomags assessment at a designated location...this test would determine who enrolled in Pre-Algebra. The remaining students were placed in Math 6 classes based on the achievement levels on the SOL [mathematics state achievement] assessments. The students enrolled in Pre-Algebra in sixth grade moved to Algebra I in seventh grade and Geometry in eighth grade. At the end of each school year, the Algebra Readiness Assessment was given to those Math 6 students who wanted to be considered for Algebra I in seventh grade. Therefore, the Algebra Readiness Assessment raw scores along with teacher recommendations usually yielded another thirty to forty (30-40) students for Algebra I in the seventh grade. Remember, those in Pre-Algebra automatically went on to Algebra I in seventh grade. Rising eighth grade students who wanted to be considered for Algebra I in eighth grade took the Algebra Readiness Assessment and a teacher recommendation.

Prior to the changes, students who were eligible for Pre-Algebra in Grade 6 actually enrolled in Math 7, skipping Math 6; then, in Grade 7, they enrolled in Algebra, skipping Math 8, and later they enrolled in Geometry in Grade 8. This system presented some difficulties with students missing fundamental skills. Participant T6 (6-10) explained that:

Even though the advanced course-offerings [prior to the changes] accelerated students [in Grades 6-8], the problem therein was some advanced students moved to the high school with missing skills due to the fact that they did not take Math 6 nor Math 8, which supported essential skills and concepts that students needed to perform well in Algebra I and other advanced mathematics classes.

Similarly, participant T4 (6-4) explained:

Kids missed too many mathematical concepts and skills that they were going to need later. Many students who were taking Geometry not only missed Math 6 but missed Math

8, skills as well. That meant that they were missing some fundamental skills, because they missed one or two years of mathematics then not only were they learning new materials but material that they should have had in [Grades 7 and 8]. I think it is better the way it is now.

**Current enrollment practices.** The changes to the mathematics course enrollment process served to prepare students better for opportunities to access advanced mathematics courses. Analysis of the Rose Middle School Course Guides (D1, 2011-2014) showed that changes in criteria for mathematics placement over a five-year period resulted in an increased enrollment in advanced mathematics classes among all eligible students (D16, 6-3), and especially for Black students in Grades 6-8 (see Table 5, Table 6, Table 7).

Table 5

*2010-2014 Changes in Enrollment Criteria in Grade 6<sup>3</sup>*

Year	Criterion/Criteria	Math Class	Total Enrollment	Black Student Enrollment
2010	Tomags Assessment above 95 <sup>th</sup> percentile	Math 7 (Pre-Algebra 6)	28 students out of 545 students (5%)	Class rosters did not indicate Black student enrollment
2011	Tomags Assessment above 95 <sup>th</sup> percentile	Math 7 (Pre-Algebra 6)	30 students out of 570 students (5%)	2 students out of 30 (6%)
2012	Tomags Assessment above 85 <sup>th</sup> percentile	Honors Math 6	87 students out of 579 students (15%)	6 students out of 87 (6%)
2013	Tomags Assessment above 81 <sup>st</sup> percentile	Honors Math 6	92 students out of 545 students (16%)	6 students out of 92 (6%)
2014	4 <sup>th</sup> & 5 <sup>th</sup> Grades SOL scores <sup>4</sup> above 500; teacher recommendation and possible review of grades. A score <sup>5</sup> of 19 or higher determined students' eligibility for the course.	Honors Math 6	128 students out of 579 students (22%)	7 students out of 128 (5%)

<sup>3</sup> Information retrieved from Rose Middle School course guides, class rosters, and membership reports. The "Enrollment Numbers" column expresses the percentages of students in Honors Classes versus total grade level population. The "Black Student Enrollment" column indicates the percentages of Black students in Honors classes versus the total enrollment in Honors classes for Grade 6 and Grade 7.

<sup>4</sup> Student performance on Virginia Standards of Learning (SOL) tests is graded on a scale of 0-600 with 400-499 representing pass proficient and 500-600 representing pass advanced levels (VDOE, 2011).

<sup>5</sup> Teacher rating forms are provided in Figure 2 and Figure 3.

Table 6

*2011-2014 Changes in Enrollment Criteria in Grade 7<sup>6</sup>*

Year	Criterion/Criteria	Math Class	Enrollment Numbers	Black Student Enrollment
2011	Successful completion of Pre-Algebra 6	Algebra I (Grade 7)	30 students out of 551 students (5%)	1 student out of 30 (3%)
2012	Successful completion of Pre-Algebra 6	Algebra I (Grade 7)	30 students out of 570 students (5%)	2 students out of 30 (6%)
2013	Successful completion of Honors Math 6 with a B or higher and a teacher recommendation. Also, students who obtain an advanced score <sup>7</sup> on the Math 6 SOL test and a teacher recommendation will be considered.	Honors Math 7	90 students out of 594 students (15%)	6 students out of 90 (6%)
2014	Successful completion of Honors Math 6 with a B or higher and a teacher recommendation. Also, students who obtain an advanced score on the Math 6 SOL test and a teacher recommendation <sup>8</sup> will be considered.	Honors Math 7	104 students out of 526 students (19%)	7 students out of 104 (6%)

<sup>6</sup>Information retrieved from Rose Middle School course guides, class rosters, and membership reports. The “Enrollment Numbers” column expresses the percentages of students in Honors Classes versus total grade level population. The “Black Student Enrollment” column indicates the percentages of Black students in Honors classes versus the total enrollment in Honors classes for Grade 7.

<sup>7</sup> Student performance on Virginia Standards of Learning (SOL) tests is graded on a scale of 0-600 with 400-499 representing pass proficient and 500-600 representing pass advanced levels (VDOE, 2011).

<sup>8</sup> Teacher rating forms are provided in Figure 2 and Figure 3.

Table 7

*2012-2014 Changes in Enrollment Criteria in Grade 8<sup>9</sup>*

Year	Criterion/Criteria	Math Class	Enrollment Numbers	Black Student Enrollment
2012	Teacher recommendation, successful completion of Math with B or higher, and/or score on Algebra Readiness Assessment	Algebra I	58 students out of 541 students (10%)	2 out of 58 (3%)
2012	Successful completion of Algebra I in Grade 7	Geometry (Grade 8)	30 students out of 541 students (5%)	1 out of 30 (3%)
2013	Teacher recommendation, successful completion of Math 7 with B or higher, and/or score on Algebra Readiness Assessment	Algebra I (Grade 8)	28 students out of 570 students (5%)	1 out of 28 (3%)
2013	Successful completion of Algebra I in Grade 7	Geometry (Grade 8)	25 students out of 570 students (4%)	1 out of 25 (4%)
2014 <sup>9</sup>	Orleans Hanna Test and a teacher recommendation. A score will be determined to decide on students eligible for the course. The test is open to all students in Honors Math 7, high level math classes and any student(s) in an average class whose teacher feels has achieved at a high level of mastery and has a pass advanced on the Math 7 SOL test.	Algebra I	125 students out of 620 (20%)	6 out of 125 (5%)

The document analysis indicated that the selection process for rising sixth graders was based on 4<sup>th</sup> and 5<sup>th</sup> grade SOL scores and a teacher recommendation that was ranked on a 1-5 scale. The teacher rating form is provided in Figure 2 and Figure 3. Furthermore, a good example of the increase in advanced mathematics enrollment numbers is shown between the 2012 sixth grade cohort who was the same 2014 cohort in eighth grade. The study participants indicated that very few students dropped out of honors and advances classes (GC1, 6-2; GC3, 6-3).

<sup>9</sup> Information retrieved from Rose Middle School course guides, class rosters, and membership reports. The “Enrollment Numbers” column expresses the percentages of students in advanced classes versus total grade level population. The “Black Student Enrollment” column indicates the percentages of Black students in advanced classes versus the total enrollment in advanced classes for Grade 8.



HONORS MATH 6.  
TEACHER RECOMMENDATION FORM<sup>11</sup>

STUDENT NAME Suzie Q

Please use the following scale to estimate the extent to which the student has demonstrated the qualities listed below in you class.

1 = Minimum (below average)	2 = Average (average)	3 = Good (above average)	4 = Excellent Top 10 percent	5 = Outstanding (top 2-3 percent)
Independent and motivated worker (work ethic)				<b>4</b>
Analytical thinker and ability to solve problems				<b>4</b>
Attention to details, organized & responsible				<b>4</b>
Committed and dedicated, cooperative behavior				<b>3</b>
Intellectually curious with a strong intuitive sense for the subject				<b>4</b>
Subtotal				<b>19</b>

ELEMENTARY SCHOOL Rose Elementary School

TEACHER'S NAME Jane Doe

*Figure 3.* Teacher recommendation form for honors math 6.

Students who obtained a rubric score of 19-25 were automatically placed in Honors Math 6. Based on state SOL assessment scores, the remaining sixth grade students would be placed in leveled mathematics classes based on established ranges of scores.

Enrollment in Honors Math 7 required successful completion of Honors Math 6 with a B or higher and a teacher recommendation. Also, students who obtained “Pass Advanced” scores on the Math 6 SOL test became eligible to enroll in Honors Math 7 if they showed success on the Orleans-Hanna assessment as well. Eligibility for Algebra I in eighth grade was for those

<sup>11</sup> Information retrieved from Principal of Rose Middle School.

students who showed success on the Orleans Hanna assessment, with a specified score on the rubric, along with a teacher recommendation.

With the changes in enrollment criteria, one study participant (GC1, 6-2) suggested that there had also been a cultural shift in Honor classes, “Society and cultures have changed. The honors cultures have changed so schools need to provide supports for those students who are in high level classes and may be a baseline student.” The change in enrollment criteria was understood as a support to later success in mathematics. As one participant (MC1, 6-30) noted:

That [criteria] is where you are going to guarantee that it works. The borderline students are the ones who could, if given the opportunity, do well in advanced classes but may need additional support with some of the process standards such as writing and explaining.

During one of the classroom observations (CO1), the teacher was encouraging a male student who was enrolled in an average math class to take the Algebra Readiness Assessment because he was a good math student and would do well. When asked, “Do you talk to students about enrolling and succeeding in advanced classes?” the respondent (GC1, 6-2) said, “Yes, we encourage students along with teachers and administrators to take prerequisite assessments so they will be considered for advanced classes.”

Study participants had mixed views on some of these changes. One area in particular that provoked a difference of opinion was the use of the “teacher recommendation” criterion. Some participants felt that the “teacher recommendation” portion of the total raw score should be weighed more heavily than any other criteria, while others felt that the teacher recommendation should not hold as much weight. One interview respondent (GC1, 6-2) stated that, “If a teacher recognizes that a child is able to achieve in honors and high level mathematics classes, they are recommended and they are moved to a more appropriate class.”

Analysis of the rubric revealed that the three criteria (namely, 4th grade SOL score, 5th grade SOL score, and teacher recommendation) were weighted more heavily for students who were being considered for enrollment in mathematics classes in Grade 6. The “teacher recommendation” rating did not carry as much weight as did the student achievement scores. As indicated in Figure 3, the total possible points for a teacher recommendation was a rating score of 5 whereas total possible points for SOL scores was a rating score of 20 (See Figure 2). One of the study participants (T4, 6-4) stated that:

The teacher knows the student really well and sometimes just because a child tests well does not mean that the child will perform well in an advanced mathematics classes.

A second impact of the changes that generated comment from participants was that very few students moved out of the math sequences that they began in Grade 6, even though a few did so. However, one participant (GC1, 6-2) explained this in this way:

We want them to stay at least one 9-weeks to see how they do. I think we do need to set standards and see how the child does, meet with parent, meet with administrator, and meet with teachers. The child may feel they are not capable but we feel they can be successful.

The findings indicated that the practice at Rose Middle School was to give the Algebra Readiness assessment to those students who were recommended for or interested in advanced level classes. Even though this idea was not addressed directly with study participants at Rose Middle School, one study participant (GC2, 4-29) explained that:

I find that because our district does not do any type of achievement testing to look at reference norm versus criterion for all students...we need to look at both. I think that not looking at a national achievement assessment is a limitation for our division. The [nationally-normed] assessment gives another piece of information.

Thus, the enrollment practices at Rose Middle School did not include the norm-referenced assessment for all students. Rather, reliance was placed on grades, SOL scores, and teacher recommendation. An Algebra Readiness Assessment was only given to those rising Grade 7 and Grade 8 students who were interested in consideration for eligibility in advanced classes.

### **Communication Resources for Enrollment Criteria and Procedures**

Another recurring theme during participant interviews was the importance of communication between home and school that directly related to mathematics enrollment processes and procedures. Many study participants felt that the parents' knowledge of enrollment processes was a vital link to Black student enrollment and success in advanced mathematics classes. Course guides, a registration timeline, and parent information nights will each be examined in this section as elements of the commitment to communication displayed at Rose Middle School.

**Rose Middle School course guide and course offerings.** The course guide was used as an information link between home and school in order to help families make informed decisions about course offerings. As stated in an open letter in the course guide from the Principal (D1, 2-4), “The guide is written to enable parents and their children to make decisions that are appropriately challenging and that prepare students for their course of study.” The course guide provided clear expectations for all classes, and especially the math classes. The course guide (D1, 2-4) also provided information about guidance counselors, teaming, standardized testing information, grade level course offerings, a math course chart outlining prerequisites, and math course offerings in next grade.

The course guide offered a graphic (See Table 2), which visually presented progression through the various mathematics sequences. Hence, the course guide published a listing of mathematics courses, the progression of those classes, and the criteria for mathematics placement in Honors and Algebra I classes. The course guide also listed academic supports that the school offered for math and English. The promotion/retention policy was also included in the guide. The course guide did not use complex language and included visuals to simplify the presentation of the information and help students and parents make sense of the course offerings and criteria. Prior to the registration process, in accordance with the registration timelines (D14, 1-23), the course guide was reviewed and revised for changes in class offerings and curriculum revisions. In other words, the course guide was another form of communication that the school used to inform families about course and enrollment criteria. As one administrator (A1, 6-6) noted, the course guide is important because “understanding the enrollment criteria may encourage more parents and students to work at a different level to access such classes.”

**Registration.** The registration timeline was an essential document that clarified enrollment processes and criteria expectations (D14, 1-23). The Registration Timeline indicated each step in the registration process, along with relevant dates, current grade levels, tasks, and who was responsible. The Registration Timeline was given to all staff because most members of the school played an important role in helping to complete the registration process. The Registration Timeline also became a device for communicating enrollment information to the elementary schools, the high school, the students, the parents, the district office, and other interested persons.

When asked to describe the registration process for advanced level mathematics courses, administrators, guidance counselors, and teachers alike agreed that it was a huge undertaking that required the full attention of faculty and staff. Based on the information from the Registration Timeline, the “course guide is submitted to the district office for approval” (D14). Once approved, other faculty and staff get involved in distribution. As participant GC2 (4-29) observed:

Course guides that go home are part of the registration process. Guidance counselors are keys to the registration process. We set up times with each PE class [to review the registration process and class offerings with the students]. We go over with the students in detail and then we send this home to the parents. There is a chart that details the prerequisites so they have this in writing. We go over this information with the students; and we hold individual conferences with parents if they want to come in and discuss registration for the next year.

Likewise, participant T4 (6-4) noted:

The course guide is sent home. We do the announcements and use the school messenger. There are announcements over the intercom so there are multiple ways (call out, text out, and emails) for students and parents to know the timeline for completing the requirements to be considered for advanced classes. Send letters home. The lines of communication are getting stronger.

Although most study participants were able to explain the registration process and enrollment criteria, some questioned whether the communication methods between home and school were strong enough to truly reach parents. When asked what strategies were used to inform students and parents about rising grade level meetings, participant A3 (4-29) stated that,

Letters, school messenger, text messaging, school announcements are used to inform families... Through the website we have the parent information nights posted. The parents have the information. I don't know if they review the information, but it is available.

Some respondents had differing opinions about the strength of the registration process, course guide communication, and parents' knowledge of advanced class enrollment criteria. For example, T1 (4-28) and T4 (6-4) agreed that that communication with parents was something the

school needed to improve upon. Respondents wondered if parents were as involved in the course selection and registration process as they should be. However, participant T2 (4-28) thought the “criteria are fair for all students...more students seem to have access to advanced classes based on the numbers this year and last year. Now I am wondering ...is the increase due to the changes in criteria or maybe the communication piece is stronger than I think.”

**Rising Grade Level Parent Information Night.** A school strategy listed on the Registration Timeline that provided an opportunity for school staff to communicate information to parents was a “Rising Grade Level Parent Information Night” hosted by each grade level during the months of February or March (D14, 1-23) (“Information Night”). During each Information Night, administrators, guidance counselors, and teachers used a PowerPoint slide show to present a review of grade level expectations, course offerings, criteria for enrollment in advanced classes (including AP courses in Grades 7 and 8), and school rules and regulations.

Information Nights were heavily attended by parents and students (A3, 4-29). However, the rising sixth grade parents asked more questions about the layout of the school than course offerings or criteria for advanced classes. In contrast, some rising seventh and eighth grade parents expressed interest in enrollment criteria (A3, 4-29).

Administrators shared their positive views of Information Nights. One noted, “Parents are not knowledgeable of the process for class enrollment. This communication piece is vital to student enrollment [in advanced classes]” (A1, 6-6). Similarly, another said, “The parent information night is another avenue to understand course selection” (A3, 4-29).

In summary, Rose Middle School implemented a variety of communication strategies to inform parents of the course enrollment, course progression, and registration policies regarding mathematics. These strategies included the course guides, registration timeline, and parent information nights. Staff generally agreed that the strategies were effective, but some participants questioned whether the communication systems about enrollment criteria could be stronger.

## **Cultural Shift towards Increased Rigor**

### **District and School Expectations and Practices**

Rose School District set specific expectations for supporting administrators, teachers, students, and parents. Specific skills and knowledge of how to supervise and implement the

standards-based curricula were required to meet the demands of the revised standards. Information derived from district office personnel, guidance counselors, teachers, and administrators indicated that the practices discussed in this section were implemented over the course of the last four years (A2, 4-28).

**Revision of curricula.** When asked about district initiatives that influenced mathematics achievement in advanced mathematics classes, participants (A2, 4-28; A3, 4-29) reported that the district made changes in the content of courses to provide better alignment with the state standards and state assessments. According to participants T5 (5-30) and MC1 (6-30), the rigor of the math program changed in response to the changes in [math standards] curriculum and requirements at the state level. Another teacher (T4, 6-4) noted that “the curriculum bumped up the rigor and there are multiple ways [for students] to solve a problem. It helped to encourage students’ thinking.”

Giving all students access to a challenging curriculum and best instructional practices was viewed as a step toward increasing students’ chances of enrolling in advanced mathematics classes, especially the most disadvantaged students. One of the study participants (A2, 4-28) described the efforts in this manner, “Our overall goal is to have a continuum of course offerings that at this level of child development are appropriate for what the student can be successful in with factors that come into play...previous preparation, their abilities that they have.”

Therefore, curriculum alignment was viewed overall as a good change in courses and achievement levels. Participant A2 (4-28) stressed the importance of

...making sure everything is aligned with the approved Virginia curriculum to try to ensure that there’s a vertical alignment from one level to the next of the curriculum since our focus here is math ... to ensure that the continuum of offerings that exist in elementary school, middle school and high school exist in support of one another [eventually supporting students’ access to advanced leveled mathematics classes].

**Process standards.** Review of curriculum documents evidenced curriculum revisions were made around the *how* and the *why* of mathematics processes. Likewise, an administrator noted during an interview that the standard-based reform seemed to set the stage for students gaining the skills to solve multi-step problems while explaining the *whys* and *hows* (A1, 6-6). While making a comparison of 2008 and 2011 Grades 6-8 mathematics state standards, participant A1 (6-6) observed that the more recent standards “ask students to think critically and

solve multi-step problems that demand a deeper level of thinking, not just memorizing and arithmetic.”

The 2011 Grade 6 mathematics state standards included more process standards that require schools to increase students’ ability to solve problems and complete rigorous tasks. Process standards include solving multi-step problems, explaining the *hows* and *whys*, thinking critically, and applying concepts to real world situations (Star, 2002). One participant indicated that, regardless of the level of the math class, “all students now have access to a challenging curriculum ... especially for those students who have had limited exposure to a challenging curriculum” (T4, 6-4). One teacher noted, “the way we do it now is much better for all students. Efforts have been made to challenge more students with a more challenging mathematics curriculum and assessments that include the process standards even though it is hard at times” (T4, 6-4). Another study participant (T1, 4-28) explained that the math teachers used various strategies that helped students meet the rigor of a standards-based curriculum, such as all math teachers were expected to integrate process standards in daily lessons giving all students exposure to rigorous tasks. Participant A1 (6-6) believed that,

We have to build teacher process standards knowledge first. Regarding mathematics, what do these standards look like when implemented in the mathematics curriculum and lesson planning. If they don’t know, then they can’t support the students’ level of learning, which can hinder students’ access to advanced learning.

**Elimination of low level classes.** Another strategy for increasing rigor was the elimination of low level mathematics courses and curricula. A review of the school’s course guides (D1) and master schedules (D17) over a four-year period revealed the elimination of low level mathematics courses and increased academic support due to the revised mathematics curriculum. Participant GC2 (4-29) explained the change this way:

We used to level the math classes low, average, and high level. But that was changed to average, high level, and Honor classes because the thinking is that your struggling math students need to be with other students who are having success so low and average classes were merged together.

Some study participants (T6, 6-10; A3, 4-29) felt that the elimination of low level classes was a positive that gave struggling learners access to a diverse group of learners and more exposure to process standards, which equated to a challenging curriculum. However, a

contrasting view was that it was easier to reach students who possessed similar achievement levels (T3, 4-29). Participant GC2 (4-29) indicated that parents tended to be more concerned about access and enrollment in Honors and high level classes than enrollment in average classes, stating that “parents will call and say I want my child here [a particular class]”.

### **Role of School Leadership**

The Principal exhibited a commitment to strong instructional leadership in order to increase the rigor of advanced math classes. She kept the school community focused on what was important to help increase student enrollment and achievement in advanced mathematics classes (T1, 4-28). Study participants at Rose Middle School conveyed that they understood their responsibilities, with comments such as this, “This is what is clear... access to positive relationships, access to teacher effectiveness, access to high expectations, and access to strong leadership at the district and school level do impact student achievement” (A1, 6-6).

The Principal stated that she “observed all math teachers for [Grades 7 and 8] ... ensured that instruction occurred... following the framework and curriculum guide, analyzed data to monitor learning, and worked with the district office to support and provided curriculum and staff development opportunities”. T1 (4-28) stated that the Principal held team leader meetings once a month to discuss any academic or school concerns and worked with the team leaders to build professional capacity. For example, the Principal wanted to make sure that teams were spending their time discussing student achievement data, instructional practices, and student concerns (T1, 4-28). Therefore, the collaboration between the administrators and within the teams did seem to address the quality of instruction (T3, 4-29).

The Principal commented that, “one of the things that I focused on was the number of minorities who were in the high level classes, especially Black students.” To support this focus, one guidance counselor stated that he/she worked closely with the “Principal to make sure that the registration process and course enrollment procedures were closely followed and monitored” (GC3, 6-3).

### **Visibility**

The findings in the study suggest that trust had been built between teachers and administrators through the administrators’ efforts at visibility. Teachers (T2, 4-28) suggested that

administrators' visibility was a priority and an essential school practice. Administrators were expected to conduct weekly walkthroughs and provide teachers with feedback regarding the classroom environment, mathematics instruction, and student achievement (Administrators' Meeting, 9-14). One teacher (T5, 5-30) said that, "visibility was important to everyone in the school."

The administrators' visibility contributed to a culture of increased rigor, increased levels of learning, and a safe learning environment (T2, 4-28). The administrators walked the halls, visited classrooms, monitored lunches and class changes, and helped with entrance and dismissal of students. A teacher (T4, 6-4) noted that the teachers invited administrators to their rooms to observe engaging activities, gather feedback, or offer support with disruptive behaviors. An administrator suggested that it was important to help "teachers implement effective instruction by visiting classrooms, providing feedback and resources so every student could have access to an engaged learning opportunities" (A3, 4-29). When asked what administrators could do to promote mathematics achievement in classrooms, one participant (MC1, 6-30) stated that, "visibility is the key to making sure we see what we are seeing and making sure we know what the teachers and students need. The only way to do that is visit those classrooms often." Therefore, the quality of the classroom engagement seemed to have a strong link to administrators' visibility in the classrooms and contributed to a culture of high expectations.

### **Culture of High Expectations**

One of the most consistent themes identified in the findings for encouraging student achievement in mathematics and accessing high level classes was holding high expectations for students. Of special interest for this study, participants highlighted three recurring themes: (a) high expectations for teaching and learning, (b) strong relationships with students, and (c) assumptions about Black students in higher level classes. Ten out of 14 interview participants mentioned the importance of holding high expectations.

High expectations were part of the culture. Holding high expectations included providing students with opportunities that encouraged them to work toward their potential (A1, 6-6). One of the guidance counselors (GC2, 4-29) explained:

Maslow's hierarchal needs suggest that we need to know our potential. Doesn't mean it is going to be easy. We are going to have to work but there is much more gratification when

we realize our potential...role models, expectations, you [student] can do this, you are going to do this and it is not just about today, but really about long term.

MC1 (6-30) commented that the students struggled to think at the level that the revised standards required, but some of the teachers held high expectations and continued to press them, while providing support and “not letting them off the hook” (A1, 6-6). Holding high expectations for all students was a central theme of the study.

### **School-wide Expectations**

The administrators set the tone for the school by holding high expectations for themselves and insisting that all students can achieve at high levels. Teachers were expected to present all students with effective instruction, present information at high levels, and provide support, when necessary, so that the students could access the curriculum (A3, 4-29). Teacher T4 (6-4) explained that,

Since I have taught multiple grade levels, I know that there are some overall concepts students must bring with them to [Grade 8], so I hold high expectations for the standards and concepts I know will support the students down the road.

One of the study participants said that all students were expected to have exposure to performance tasks (A3, 4-29), regardless if they were in Honors, high level, or average mathematics classes. Figure 4, below, shows an example of a [Grade 6] performance task that students had exposure to during classroom observations.

**1. Jodi is replacing the carpet in her bedroom closet. Her rectangular closet has an area of 48 square feet and a perimeter of 32 feet. What are the length and width of the carpet that Jodi must buy so that her closet floor is completely covered? Follow the steps below.**

Step 1: Read It.

Step 2: Think it: list any information that may help you solve the problem.

Step 3: What is the question you must answer? There could be more than one...list all.

Step 4: Solve it. Show your work. Write the solution to the problem using complete sentences.

Step 5: Write it. Describe how you solved it.

Step 6: Review it. Does your answer make sense?

*Figure 4. Sample performance task.*<sup>12</sup>

<sup>12</sup> Information retrieved from Grade 6 Mathematics Curriculum.

MC1 (6-30) stated that “Process standards... are the goals of what we want students to be able to do: communicate, apply knowledge, problem-solving, make connections and writing an explanation of what occurred while investigating the solution. This is an expectation for all children.” Many of the study participants agreed that students struggle, especially those who have not been exposed to this level of learning, but the participants expected the students to eventually gain the skills necessary to complete a performance task with limited support from the teacher. An administrator (A1, 6-6) explained holding high expectations using a Constructivist framework:

Children need to make their own meaning out of things. They may struggle through it but it is okay for them to struggle...that struggle is their brains telling them that they better figure this out and this is when the learning is going to stick. Students have disequilibrium and that is the fertile ground for learning. It is okay to allow kids to struggle. Teachers’ instinct is to help kids, but struggling is a good thing.

Two teachers presented similar performance tasks as in Figure 4. In one honors class (CO3), the students were able to complete the process with the teacher facilitating a review of the problem. In the other class (CO4), which was preparing the students for the opportunity to enroll in advanced classes, the students needed more support with each step.

<p>Problem of the Week: October 4-8 The Muffin Man</p> <p>Bob wanted to purchase some muffins. A dozen muffins cost \$4.95 including tax. He wanted to purchase 4.5 dozen. If Bob gave the cashier \$20 <i>about</i> how much more money would Bob need? What would be the exact cost of the muffins?</p> <p>Illustration/Scratch work: Explanation: (complete sentences): My Answer:</p>
---

*Figure 5.* Sample problem of the week sample<sup>13</sup>, as described by one study participant, was an extension of the performance task (see Figure 4), which provided those students in honors math with a more challenging weekly task.

One classroom observation in particular (CO1) supported the findings from the study participants’ interview responses that honors students were given opportunities to complete

<sup>13</sup> Information retrieved from Grade 6 2013 Mathematics Curriculum.

*Problems of the Week* (see Figure 5) that included writing and explaining answers. After about five minutes, the teacher stated, “what do you need to know in order to complete this task?” and reminded the students that, “they knew they needed answers written in complete sentences.” The teacher was walking among the students and monitoring their work. Instruction occurred from the moment the students walked into the classroom until the end of the class period. The study participants indicated that there was one difference between honors and other mathematics classes. The students enrolled in honors classes were expected to complete the “Problem of the Week” (D10) (see Figure 5). One of the study participants (A2, 4-28) concluded that,

For the last 15 years we have taught children how to take a test; overnight we want them to think beyond the obvious...it is going to take time. They can do this...it is going to require patience from administrators, teachers, and the students while we all build our skills to facilitate this type of learning.

### **Student-Teacher Relationships**

Teachers (T4, 6-4; T3, 4-29) agreed that building positive student-teacher relationships was important. “Kids are going to do better with [teachers] they feel care and want them to do better” (T4, 6-4). The same teacher said that,

I will never ever tell a child that you can’t do this or you can’t do that. Children at the middle school have not grown to their potential so we don’t know what that child can accomplish. Our job is to help motivate them to do the best they can do. Give them all chances. (T4, 6-4)

Another participant (A1, 6-6) stated:

We have to know our learners and figure out what turns them on and what is going to get to them. Some of it is opportunities in creating meaningful tasks that students have access. Students need multiple opportunities to think concretely. If we can make tasks meaningful to kids, teachers have to be committed to it. If you have kids who cannot access your tasks then you should be asking why. Why can’t they and then design some tasks that they can. Kids have different learning styles, different kinds of intelligences.

As participant T5 (5-30) explained,

We have to structure so that every kid can rise to the level that they can rise to. That we don’t impose this notion about what people can do. We need to eliminate barriers as best

we can...sometimes we need to reach down and tell a kid you can do this...you have greatness in you.

What is particularly noteworthy is many of the study participants agreed that holding high expectations and building relationships helped to sustain and support mathematics achievement.

### **Assumptions about Black Students in Advanced Classes**

Participants were asked about the type of support that was provided for those Black students who were enrolled in advanced mathematics classes. Typical responses indicated that teachers did not think that Black students in such classes required any additional or special support to succeed. For example, one study participant indicated that, “reality is those Black students who are in advanced mathematics classes do fine” (T5, 5-30). Another stated that, “usually Black students don’t drop honors classes and normally they don’t need [remediation] support” (GC1, 6-2). Another teacher (T4, 6-4) explained how her views had changed over time about encouraging Black students to enroll in such classes:

Black students have been in my high level classes. I try to encourage those students who have the ability to do the work. Today, I would have said you are going to take the next highest level, instead of saying let’s talk about it. There is really nothing to discuss. If a child has the ability, then he or she needs to be in those classes. It is important for us [math teachers] to point students in the right direction regardless if they want to do it or not.

MC1 (6-30) gave the opinion that high achievers did not need [academic] support; students who fell on the criteria borderline, on the other hand, would most likely do well in advanced mathematics classes with academic support.

When asked what the school could do to encourage Black student enrollment in advanced mathematics classes, study participants made general statements such as “The more students are exposed to challenging mathematics problems, the stronger they will become” (T1, 4-28).

Exposure tended to be a common theme among teachers and administrators. A teacher (T2, 4-28) explained, “Honestly, I don’t know why we don’t have more Black students in high level classes. Because I feel we have clear requirements for every student to get there. I don’t know if math is not a strong point.” Participant GC2 (4-29) believed that “the Algebra Prognosis

test should be given to every student so we don't miss any students who have the capability to do well in these classes." Teacher T2 (4-28) suggested "encourag[ing] parents about rigor of instruction and helping them understand, if they want the child to pursue a college path, the child really needs a challenging curriculum." Another study participant felt that "Questioning is the key. Formative assessments are the key. The data can provide answers to why and most importantly, if parents don't come to school, the school needs to go them" (A1, 6-6).

The study participants felt that Black students who enrolled in advanced mathematics classes performed as well as their peers and did not necessarily need tutoring or remediation. Black students in high level or honors classes did not need the remediation or tutoring that the school provided any more than White students did. Study participants suggested that students in advanced mathematics classes possess the mathematics proficiency needed to solve challenging problems (MC1, 6-30; T5, 5-30; T1, 4-28).

On the other hand, some participants voiced concern about the home support Black students received and stated that "Some [Black students] had a harder time completing homework and other assignments, but were very bright and could do the work" (T1, 4-28). To support the students, some classroom teachers would ask the students to come to see them during homeroom time or during electives to complete any unfinished work. Some teachers worked with grade level administrators for students to stay after school to complete any unfinished work. One study participant raised some concerns about this strategy, though, because some families lived far from the school and may not have had the means or transportation to pick up students (T1, 4-28).

### **Culture of Continuous Learning**

The findings suggest that administrative and teacher capacities are especially important for support of mathematics achievement. The professional development opportunities for both administrators and teachers were important as the staff developed math proficiency that fostered the enrollment and achievement of students in advanced mathematics classes. This section discusses how the school and district provided administrators and teachers with professional development opportunities.

## **Administrators' Professional Development**

The school's leaders were expected to participate in staff development to improve their ability to recognize effective mathematics instruction, build familiarity with math proficiency, and foster positive classroom environments. All the administrators participated in training that focused on *Lookfors* during mathematics instruction (D11, 8-6). The *Lookfors* included effective strategies that should be seen in mathematics instruction and related activities (Mirra, 2003). Study participants felt that mathematics classroom *Lookfors* helped to establish high expectations for the school and were an essential component for "monitoring what the students are taught and how they are taught" (A3, 4-29).

During 20-30 minute observations in four classrooms, the researcher observed some practices and strategies that participants discussed during several interviews regarding increasing teachers' ability to instruct at rigorous levels and administrators' ability to monitor what was occurring at the classroom level. These observed practices were also noted on the "Administrators Lookfors" (Mirra, 2003):

- (a) Students were explaining their thinking.
- (b) Students were exposed to challenging problems that required them to write explanations about how they solve problems.
- (c) Students were working in groups or pairs.
- (d) Students were writing about their math processes.
- (e) The teacher was giving encouragement. (CO1)

Administrators also attended state level workshops to support the implementation and monitoring of effective instructional practices in the mathematics classrooms. The participation of administrators in professional development was important for supporting teachers' effectiveness and students' mathematics proficiency, which in turn supported enrollment and achievement in advanced mathematics classes.

**Administrative support and feedback.** The administrators' learning was grounded in the day-to-day work of the school that supported effective teaching practices. The administrators used their learning to provide embedded professional development. Administrator A3 (4-29) stated that the administrators' responsibility was to provide support so people can do the best job that they can do. For example, the Principal met with the grade level administrators every Monday morning to discuss school-wide initiatives and concerns in order to ensure that the grade

level administrators were consistent and doing their best to support teachers and students. Support included providing effective feedback to teachers with mathematics-specific instructional practices. Comments from other participants echoed this belief. When asked how the administration supported mathematics instruction that fostered enrollment in advanced classes, typical responses were “providing teachers with staff development that focused on engaging classrooms and then providing feedback” (GC1, 6-2).

Most study participants agreed that teachers had been given support and feedback on what they were required to do (T1, 4-28; T2, 4-28). Hence, “the math teachers as a whole should be at a different teaching level than they were five years ago” (A3, 4-29). Teachers agreed that, “if we continue to be supported with how to teach the process standards, then [the students] will be able to conquer such questions” (T5, 5-30). “The key is the support the school provided teachers and students at any level” (T6, 6-10). Teacher T1 (4-28) noted that

I think that three things are provided very well...the first thing is feedback from our administrators in and out of classrooms. The allowance of math meetings where we can strategize and talk about common assessments...common activities [workshops] that encourage teachers to be more collaborative than competing against each other. Administrators supported that idea. Administrators offer opportunities for ways to become a better teacher such as attending conferences, peer observations, and leading workshops.

### **Teachers’ Professional Development**

The district and school also set aside time for teachers to build effective instructional practices to increase teachers’ effectiveness to meet the demands of the changes in the Grades 6-8 mathematics standards. One administrator (A2, 4-28) described the situation as “we have been asking [the teachers] to do it [teaching] one way for 15 years. The majority of teachers... that’s the only [low] level they have ever known in their teaching career...that’s half of a career. So now we’re asking them to modify their instruction to meet a goal or step over a bar [rigorous standards] that they know very little about”.

Participants noted the link between increased rigor for students and teacher preparation to deliver increased rigor with instruction. One study participant stated that, “what we have to be concerned with here is not the increased rigor on the assessment but the increased rigor of

instruction in the classroom. That's what we work hard to ensure" (A2, 4-28). Participant MC1 (6-30) explained that:

Teacher capacity is another one. Teachers today need to understand the math content.

They need to be able to [teach] in terms of the learning theory. It is a constructivist focus that we don't just tell children, they have to build meaning themselves. We are facilitators of learners.

Many participants indicated the value that came from professional development opportunities. Administrator A1 (6-6) provided specific examples of how the district and school supported the instructional staff:

Teachers have had a tremendous amount of professional development. (1) We had UVA come and teach numbers and number sense to middle school teachers. When the new standards came out for sixth and seventh grades, when we started testing, we saw that we would get a bang for our buck due to students' achievement at that time. The UVA course was over a semester for eight or nine weeks. (2) Teachers were released from classrooms a whole day, and had sub coverage, so they were able to take class during the regular school day at the district office away from their schools. (3) The class was paid for by the division. And (4), they received the 90 credits [for recertification]. We wanted to build the teaching capacity of the middle school teachers with the new standards, especially those standards with embedded process skills. (A1, 6-6)

Other participants also commented on the efforts made to support teacher professional development. Administrator A3 (4-29) noted:

Once [district officials] know the school's needs, they do a good job of meeting those needs, such as sending people to workshops, staff developments, classes, providing resources for the classrooms, making sure classrooms have the latest technology...they are continuously looking at ways to support schools and instruction...Sometimes staff members need the rationale in order to move forward with a change initiative.

Another administrator agreed that,

[Teachers] have taken classes, individuals from the outside came in and observed to provide feedback, and their peers come in [classrooms] and provided feedback. They have been able to have someone model lessons. A lot of purposeful planning and funding have gone into providing effective staff development in various ways, and classroom

resources, to ensure they have the essential teaching knowledge, content, and strategies to meet the needs of all learners. (A2, 4-28)

Experiences with high quality staff development supported not only increased effectiveness, but also a shift in thinking. Teacher T4 (6-4) expressed it this way:

The division provided a class during the regular school day that was based on fractions. We started out thinking we already know this and how to teach it but the professor was able to help us think completely differently about teaching mathematics and how different kids think differently. It was neat to see, even though we all had mathematics degrees, how we all think so differently and this is the way it is for our students. One person might do a problem completely different from another person and that is the way our kids are so she got us to think in a different way and provided a different foundation with teaching.

She (T4, 6-4) added:

as we progressed through the math class and the professor kept pressing us and asking us why...as we do our kids in the classroom, we finally realized that we all have different ways of thinking about problem-solving just like our students.

When considering the professional development and curriculum development opportunities, another teacher stated that, “the work was not easy... but it was worth it” (T5, 5-30).

Another goal of the professional development was to develop knowledge of the teaching strategies in order to support implementing rigorous mathematics standards aligned with the higher levels of Bloom’s taxonomy: applying and synthesizing. Teachers’ staff development revolved around helping teachers with procedural and conceptual mathematics knowledge, problem-solving techniques, questioning techniques, and understanding how to instruct on the level of the revised mathematics standards to meet the demands of high level classes.

Administrators expressed a strong commitment on the importance of staff development:

The school and district have worked to build teachers’ conceptual knowledge as well. Students will come out with a better background and have access to effective teaching. What approach the teacher takes has a lot to do with a student’s achievement level.  
(MC1, 6-30)

When asked to describe what the school could do to increase enrollment in advanced classes, one study participant explained that,

A teacher's questioning ability is the key to student mathematics achievement. Teachers need to be able to know the questions to elicit what kids are thinking. We have to get kids to begin to think on their own and teachers need to know how to get to that level based on the questions they ask, the observations they do, and activities they present. Eventually students will see a need to use mathematics to solve problems. The questions, and some of that is hard, because teachers have to think on their feet. Those teachers who come with the ability to question and question well; those children who have access to these teachers tend to manipulate math at a higher level than those students who have teachers whose questioning skills are limited and are not able to provide students access to meaningful tasks. (A1, 6-6)

Administrator A3 (4-29) added that the math teachers are at a different level because the school has placed heavy emphasis on effective instructional practices. He stated, "If teachers can inspire students and use varied instructional strategies and make it applicable to real life situation then we will see more students achieving at higher levels" (A3, 4-29).

Site observations made it very evident that the teachers had intensive staff development. The various classroom environments had more similarities than differences. The teachers had a strong understanding of the math standards and the rigor of the standards, a conclusion based on observations of their ability to answer students' questions and help them with problem solving strategies. The instructional strategies and practices identified in Table 8 were derived from a review and analysis of faculty meeting notes, staff development notes, classroom observations, and interview responses.

Table 8

*Instructional Strategies and Practices*<sup>14</sup>

---

Best Practices (*presented in faculty meetings, workshops, and staff development opportunities*)

---

- Continuous use of data to adjust delivery of instruction and related activities
  - Putting students in small groups and pair-sharing activities
  - Providing student exposure to technology enhanced questions (TEI)
  - Vocabulary development of mathematics terms in real life application
  - Scaffolding with Bloom's Taxonomy
  - Team members meeting weekly to discuss student achievement and other areas of concern
  - Integrating *The Active Classroom: Seatwork to Feetwork* into lesson planning
  - Integrating mathematics concepts in Science, Social Studies, and English
  - Making contact with parents
  - Utilizing tutoring and other support systems
  - Use the Response to Intervention (RtI) process when students experience on-going struggles
  - Involve the guidance counselors for students' emotional and social support
  - Increasing rigor in delivery of instruction, assessments, and questioning
- 

Overall, the teachers appreciated the collaboration and professional development opportunities offered to them and felt that it helped to increase their effectiveness. Teacher effectiveness was influenced by the staff development opportunities and teachers' ability to implement a rigorous curriculum. Study participants suggested that teacher effectiveness seemed to link to student achievement. Participant GC1 (6-2) stated, "Teacher effectiveness is huge... That absolutely drives instruction and command of the curriculum." All Grades 6-8 teachers received intensive mathematics staff development; therefore, all students had access to teachers who received intensive professional development in effective mathematics instruction. A challenging curriculum and effective instruction supports all students' achievement, which would bode well for Black students.

In summary, standards reform at the state level charged districts and schools with implementing practices to ensure that all students have access to a challenging mathematics curriculum, best instructional practices, and rigorous performance assessments. Rose School

---

<sup>14</sup> Information obtained from faculty meeting agendas, staff development information, and participant interviews.

District and Rose Middle School administrators worked with staff to create a culture of continuous learning: aligning mathematics curricula with state standards and providing intensive professional development. These initiatives were designed to increase students' "problem-solving and critical thinking skills as well as their content knowledge" (A1, 6-6), which study participants believed to impact student access to advanced classes. Professional development was geared toward increasing rigor in the curriculum, developing higher level questioning skills, and using common assessment data to support instruction. Study participants believed that the principal set the tone for a learning community that supported the teachers and the students. Efforts were made to improve instruction with specific detailed expectations to support mathematics achievement and enrollment in advanced mathematics classes. These efforts were strongly linked to school-related in-services, workshops, and professional development opportunities.

### **Data Sharing**

Data sharing was seen as an essential component of student access to advanced classes. Teacher T6 (6-10) said, "It is an expectation of the school that we all monitor data ... how will we know how our students are achieving ... we monitor and adjust as the year progresses."

### **School-wide Practices**

Participants explained that data analysis was a school-wide practice. The teachers provided administrators with data analysis information after each benchmark assessment, including honors and high level math classes. Participants GC2 (4-29) and A1 (6-6) agreed that there are many variables to success and that "the data piece is very important". An analysis of the interview responses suggested that the school used data (a) to inform or adjust instruction, (b) to hold informal meetings with teachers to discuss classroom practices or provide students with remediation or extension activities, and (c) to determine if students were placed appropriately" (A3, 4-29).

Data were available to guide teaching efforts, adjust instructional practices, and determine students' placement. As teacher T2 (4-28) noted, "The data can help to determine the direction of instruction and the academic support that should be provided to students." She believed that a culture of data sharing "started with the teacher, then administrators, and now we

are seeing more monitoring at the [district office].” More importantly, MC1 (6-30) noted, “Teachers must have the skills to recognize when any students are standouts in reading, literature, Social Studies, Science, and Mathematics. This is the only way we will know if students are misplaced. The data can help us do that.” Two guidance counselors (GC1, 6-2; GC3, 6-3) explained that students are placed in leveled classes based on prior mathematics achievement: grades, teacher recommendation, and SOL scores. Students’ previous performance may not indicate their actual achievement levels, so when the data highlight students who are misplaced in mathematics classes, the teachers work with administrators and parents to appropriately place students.

### **Remediation and Extension Activities**

The school offered mathematics support to struggling students to increase their chances of learning the curriculum, as well as extension activities to students showing proficiency on benchmark assessments. A block of time was built into the master schedule to provide students with math and reading remediation or extension opportunities (D4, Plan of Support, 2012-2013) called WIN (“What I Need”). The WIN classes were built into the schedule during the 2012-2013 school year. The premise around the WIN time was to individualize attention to student needs, whether it was remediation or extension activities. Information obtained from school guidance counselors suggested that, during the class enrollment process, targeted students with specific SOL scores were enrolled in math and reading WIN classes to receive additional support based on academic needs (GC1, 6-2; GC3, 6-3). During this same time, the remaining students who did not need remediation support were provided extension activities such as science exploration, culinary experiences, or art opportunities.

Tutoring logs and study participants indicated that students identified for tutoring were enrolled in average mathematics classes. Teacher T2 (4-28) stated that teachers take extra time to work with students in trying to prepare them for the next level. Several teachers (T1, 4-28; T4, 6-4; T6, 6-10) stated that students in honors and high level classes very rarely needed remediation support. When asked what happens if a student in honors or high level classes needed additional support, teacher T4 (6-4) explained that “the classroom teacher normally works one-on-one with the student during class time.”

In summary, several study participants noted that data sharing can be a positive factor in students' accessing advanced mathematics classes. The school staff was committed to establishing and monitoring data systems that supported student achievement because they knew the "answers were in the data" (A1, 6-6). The teachers used a variety of data sources to detect needed adjustments in instructional practices and to monitor student progress. Student progress measures not only highlighted academic weaknesses but also those students who could achieve at higher levels. Data were also used to determine whether students needed specific remediation and extension interventions.

### **Perceived Barriers to Enrollment**

The third research question asked about barriers that may impede Black student enrollment and/or achievement in advanced mathematics classes. The interview participants suggested that a variety of personal and school-level factors impacted Black student enrollment and achievement in advanced mathematics classes. It must be noted that the findings in the study surrounding perceived barriers were particular to Black students who were not enrolled in high level classes. In contrast, the findings in this study suggest that Black students who were enrolled in high level classes tended to have family and/or teacher support, and the necessary skills to achieve in advanced mathematics classes. Even though the study participants presented many hypotheses as to what might cause the problem, including parental influences, community influences, and student capacity, this section will focus on specific findings from the study that are therefore organized into the following themes: communication, school practices, teacher preparation (effectiveness), and cultural beliefs.

#### **Communication**

Stronger communication about enrollment processes and established criteria for advanced classes was perceived as important and seemed to contribute to Black student underrepresentation in advanced mathematics classes. This position was voiced by teachers, guidance counselors, and administrators. As discussed earlier, one teacher felt that communication was a barrier across all boundaries, when she stated that communication seems to be one of the most essential factors to students' access to high level classes, especially for Black students (T2, 4-28). Another teacher (T6, 6-10) suggested that communication, used in a

broad sense, included both parents and the school partnering for the benefit of the student. She stated that student enrollment comes down to the:

Parents' ability to communicate with schools. Schools' ability to communicate with parents. Teachers' ability to communicate high expectations for learning. Principals' ability to communicate high expectation in the overall school community and teachers' ability to communicate with other teachers.

Teacher T2 (4-28) said that she thought that communication with parents was something that the school needed to improve. She was not sure that the school involved parents as much as they should with course selection. She was concerned that parents did not know as much as they should about enrollment criteria in advanced classes and wondered if this knowledge would help increase enrollment in advanced classes.

When study participants were asked if they could describe specific barriers to enrollment, one questioned whether the school did enough to help parents understand the enrollment process (T1, 4-28). Another study participant agreed (A1, 6-6) that the communication piece was vital to student achievement and also "wondered if parents understood the enrollment criteria and course-taking more in-depth would families be encouraged to work at a different level to access such classes".

Several respondents stated that even though communication between home and school was an essential factor to students' mathematics enrollment in advanced classes, especially for Black students, "enrollment [criteria for] advanced classes [is] not communicated very well to everyone" (T6, 6-10). The level of school involvement with the parents may contribute negatively to Black student enrollment in advanced classes. A common response was that the school needed to improve parental involvement (T1, 4-28), which may be interwoven with the strength of the communication between home and school. The same teacher felt the school should educate the parent along with the child about enrollment criteria.

When asked about barriers to enrollment in advanced classes, one teacher (T3, 4-29) stated that "I think the school, and that's even starting from [district office], could do a better job in reaching out to minority parents and just actually sharing the data number one but it has to be shared at a level that they can understand but we don't get those groups together or attempt to get them together." As administrator (A3, 4-29) explained:

I would like to see our Superintendent attend meetings where there are Black parents and talk to them about what the data show. Tell them that we need your help. I guarantee...he would touch someone. The community would appreciate the Superintendent taking the time to come and speak with them about their children. I believe it could make a difference with our parents.

An interesting pattern that emerged from the findings was that the church was seen as a central place for communicating with Black families and emerged as a central theme from several participants. One teacher (T4, 6-4) stated, “if you want to speak to Black families ...go to the churches.” An administrator A3 (4-29) agreed that, “one avenue is through the churches.” Beyond linking communication at the school level to the home, one teacher (T4, 6-4) described the issue with communication in this way, that “maybe the school [did] not make the necessary changes with the way the school communicates with families, [thus communication] could most definitely be a barrier” [to enrollment in advanced classes]. These statements suggest that schools must use innovative ways to communicate with a diverse group of parents if the goal is to increase minority student access to advanced mathematics classes.

### **School Practices**

Study participants indicated that students may face enrollment barriers at the school level, such as inconsistency with implementation of enrollment practices, scheduling practices and time, and teacher preparation.

**Consistency with enrollment practices.** One guidance counselor (GC2, 4-29) stated that, “we have to make sure we are looking at all criteria appropriately. I have seen children experience such barriers. I cannot honestly say that all children are placed appropriately”. The same guidance counselor was concerned that teachers, sometimes, do not recommend students who may be able to do the work. She suggested that the school must stay focused on the written criteria regardless of the student’s background. Another guidance counselor (GC3, 6-3) agreed that inconsistencies among teachers may exist. She stated that “one may have recommended [a student] and another may not recommend the same student”. When asked about barriers to enrollment, one teacher (T2, 4-28) stated

We should look at our requirements and determine, even though they’re fair, but are they appropriate for every student. It [enrollment criteria] may not be appropriate for each

student. You [the school] may have to consider more than just SOL scores as to where you're [the students] going to be placed and sometime a teacher recommendation may not be the right decision for the child.

While some of the study participants were careful to express beliefs that individual Black students were as capable as individual White students (T1, 4-28; T2, 4-28; GC2, 4-29; MC1, 6-30), there seem to be beliefs that could raise questions about how bias could enter into teacher recommendations for advanced mathematics classes. Consistency with enrollment practices may be a positive factor that impact student access to such classes at the middle school level.

**Environmental factors.** When study participants were asked to describe barriers that hinder enrollment in advanced mathematics classes, some study participants identified grouping, scheduling, school size, and time as environmental factors that impacted enrollment in advanced mathematics classes. One teacher (T6, 6-10) expressed concern about the way students were grouped for math classes, suggesting that some students needed other students as role models for critical thinking and problem solving. In contrast, another teacher (T2, 4-28), stated that it was easier to reach students with similar abilities. The scheduling of math classes was identified as a barrier for some students, when one teacher stated that, “scheduling math classes in the late afternoon was a barrier to learning for some students.” An administrator (A3, 4-29) felt that the middle school [Rose Middle School] was too large. The administrator stated that,

If I had my way I would split this school into two different schools...when you look at other middle schools surrounding us, they are half the size. They [other middle schools outside the district] have time when kids can go to clubs, or can do homework...all these activities are important.

Time was also a recurring theme. An administrator (A1, 6-6) stated that “time is a huge factor and more time is required to meet the needs of students and teachers”. The same administrator said, “so finding time for more mathematics instruction [cannot] always work so there is a time constraint for additional mathematics [instruction]” (A1, 6-6). Continuous professional development, funding, and time were noted as barriers by another administrator (A2, 4-28) when he said that,

I think the one thing that I wish we had the money and time to provide teachers with more opportunities... it [professional development] has to be supported from year to year... it can't be the fix all that lasts for two weeks.

In agreement, GC1 (6-2) stated, "if the teacher does not have the time to have command of the curriculum, how are you going to reach the different types of learners if the teacher does not have command of his or her craft?"

### **Teacher Preparation (Effectiveness)**

Even though the administrators and teachers at Rose Middle School had intensive professional development opportunities, some study participants felt that teacher preparation and effectiveness remained perceived barriers to enrollment. When participants were asked if they could describe specific barriers to enrollment and achievement in advanced mathematics classes, administrators, teachers, and guidance counselors made similar statements about teacher preparation and effectiveness.

Some teachers (T3, 4-29; T1, 4-28; T2, 4-28) agreed that it did not matter how smart the students were, teacher preparation was an essential component for students' mathematics achievement. One of the teachers (T3, 4-29) stated, "can you imagine children having a very ineffective math teacher? That's not good". Another recurring statement was "it goes back to the teacher they [students] have (T1, 4-28). Teacher effectiveness was identified by a guidance counselor as "huge" when GC1 (6-2) stated that, "If a teacher does not have command of [instructional practices] then learning cannot occur. That [command] absolutely drives instruction. [Teacher] command of the curriculum is another issue". The same guidance counselor suggested that the school's ability to provide teachers with what they needed was a barrier because "there were new technologies and instructional practices to help students access a challenging curriculum" (GC1, 6-2). Administrators voiced similar responses to the teachers and guidance counselors that, "making sure the teachers have the skills and abilities to recognize when students need remediation or enrichment" (A2, 4-28) may be a barrier; "[some teachers] do not understand that there are five process standards that need to be at the same level as the content knowledge. The process standards are the goal of what we want students to know and do" (A1, 6-6). Another administrator (A3, 4-29) was concerned that some teachers have a "generalist degree but are now expected to be able to teach mathematics at a very rigorous level

of instruction with depth.” The long-term effects of teacher practices were noted by one administrator (A2, 4-28) as a barrier, such as when “some of our students are able to make a choice [mathematics enrollment], they have been turned off to mathematics because of the classroom level [practices] that we do.”

### **Cultural Beliefs**

Until this point, the barriers identified have been at the school level. One interesting theme that emerged from the data is the impact cultural beliefs may have on access to advanced mathematics classes.

Study participants’ responses suggested that cultural beliefs, specifically Black cultural beliefs, were barriers to Black student enrollment and success in advanced mathematics classes. For example, some participants stressed the importance of “building a culture for all learners” (T5, 5-30). Similarly, Administrator MC1, 6-30) explained that:

Whether we like it or not, the child in poverty and the Black child from the middle class home don’t necessarily run with the same levels (peers) and by that I mean that Black males from the middle class home with both parents saying you will go to college. Either the child is making a transition to a different peer group that is not Black or is trying to stay with a Black group that is...not interested in college. Black students’ acceptance from their peers has not always been positive especially if they are doing well in school. One teacher (T5, 5-30) stated that, “it is really not too cool to be smart or to be overtly smart. I don’t know how to handle that ... especially for those Black students who need to be in those classes.” Another study participant was concerned that, “they don’t think they can achieve in those classes, and more importantly, they don’t want to be seen as a nerd among their peers, as someone who is so smart or intelligent” (A3, 4-29).

Accordingly, one participant (GC2, 4-29) suggested that “sometimes [children] just seeing others who have had success [was seen as important]. Children can see this is what you do. There are so many variables that impact what is happening with our Black children”. It should be noted that the data did not establish that these *were* Black cultural beliefs; rather, the comments are framed in the data as the participants’ perceptions or assumptions *about* Black cultural beliefs.

An important finding from participant responses was that some Black students are very capable of achieving in such classes; however, some factors may lend themselves to work

against enrollment and achievement at the school level. Communication about enrollment practices and school practices were well noted as vital components to student achievement in advanced mathematics classes. There were also responses that suggested that there are additional factors (school practices and teacher preparation) that may hinder access to such classes. Additionally, an important finding from participant responses was that certain Black cultural beliefs are perceived as working against enrollment.

### **Summary of the Findings**

The important practices that school leaders and school personnel used to implement the change process to increase student access to advanced mathematics classes at Rose Middle School, and to provide a challenging curriculum to all students, have been presented in six categories of findings. These categories included: (a) Mathematics Placement Innovations, (b) Cultural Shift towards Increased Rigor, (c) Culture of High Expectations, (d) Culture of Continuous Learning, (e) Data Sharing, and (f) Perceived Barriers to Enrollment.

Study participants from the district to the school level indicated that the revision of state mathematics standards was the catalyst for changes at the district and school level. The school leader was seen as essential in leading the mathematics placement innovations that took place at Rose Middle School. The participants believed that the Rose School District and Rose Middle School supported the rigorous changes in standard-based learning, teacher collaboration, and teacher capacity, thus contributing to students' mathematics achievement and enrollment in advanced classes. The cultural shift in thinking seemed to be a byproduct of curriculum and instructional changes that occurred. Communication across district, school, and community was seen as an important factor impacting curriculum revisions and instructional practices. District and school leadership and practices were catalysts for changes in enrollment process, curriculum development, and teacher effectiveness. High expectations for administrators, teachers, and students were strongly associated with positive teacher-student relationships and the collaborative culture found in the school.

Study participants felt that there were a variety of personal and school-related factors that placed all students, and Black students in particular, at a disadvantage for enrolling in advanced classes. The most often mentioned barrier tended to be communication between the home and the school. Communication was seen as an area in which the school needed to improve, due to some parents having limited knowledge about mathematics enrollment processes and criteria, as

well as the value of mathematics itself. Additional barriers included school practices and teacher effectiveness. At the student level, the most frequently mentioned barrier was perceptions of cultural influences that tended to impact student enrollment in advanced mathematics classes. Chapter 5 will present a discussion of these findings, implications of the study, recommendations for future research, and a conclusion.

## **Chapter 5**

### **Discussion, Limitations, Implications, Recommendations, and Conclusion**

The purpose of this study was to examine the practices, policies, and strategies that Rose School District and Rose Middle School used to prepare and support Black student enrollment and achievement in advanced mathematics classes. A case study approach was used. Data were collected through structured interviews with key individuals who influenced enrollment and achievement changes, on-site observations, and review of relevant documents provided by school personnel. Findings were presented in Chapter 4. In this chapter, those findings [related to the three research questions] are discussed and evaluated. Chapter 5 is divided into the following sections: Discussion of Findings, Implications, Recommendations for Future Research, and a Conclusion.

#### **Discussion of Findings**

The conceptual framework of the study was based on the framework of essential supports articulated by Bryk et al. (2010), which suggests that, “almost everything interacts with everything else” (p. 45). The framework identified critical elements that guide the development of school practices and support systems, including (a) strong school leadership, (b) professional capacity, (c) instructional guidance, (d) student-centered learning, and (e) parent-community ties. This framework and related literature (Adelman, 2006; Aud et al., 2010; Cotton, 2003; Daggett, 2005; Darling-Hammond, 2007; Edmonds, 1979; Ferguson, 2007; Jeynes, 2007; Ladson-Billings, 1997; Lezotte, 1990; Loveless, 2008; Marzano, 2003; NCTM, 2008; Ogbu, 2003; Reeves, 2003; Spielhagen, 2011; Walker, 2007) guided the development of interview questions that were asked of district and school-level personnel, as well as on-site observations and review of documents. In this section, the findings of this study are interpreted as they relate to the existing literature and, particularly, Bryk et al.’s framework.

#### **Mathematics Placement Innovations**

Previous research has found that, if Black students are to enroll in and have success in advanced mathematics classes, change has to take place from within the district and within the school (Adelman, 2007; Boykin & Noguera, 2011; Williams, 2011). The category of mathematics placement innovations included the patterns of change management, an examination of the change in enrollment criteria, and resources that communicated the changes

in enrollment criteria and procedures. This is significant because the research indicates that underrepresentation is the “status quo” in many schools (NCTM, 2002; Walker, 2007), which means that change will be required.

**Historical enrollment practices.** Prior to the changes in enrollment criteria and math class offerings, a historical review indicated that some accelerated students had the opportunity to take Geometry in eighth grade thus providing access to advanced leveled classes at the high school level and earlier access, if accepted, to the Governors’ School. Geometry has tended to be a prerequisite for some advanced mathematics classes and a Governors’ School criterion. However, study participants noted that a common problem was students often missed fundamental mathematics concepts if they were accelerated even though students had the opportunity to take Geometry at the middle school level. Therefore, the change process included discontinuing Geometry at the middle school level to eliminate the problem of students missing Grades 6-8 math skills. Currently all students enroll in Grades 6-8 mathematics classes. The lingering question is, did the solution to eliminate Geometry at the middle school level limit or delay students’ access to advanced level classes? Current accelerated students take Geometry in 9<sup>th</sup> grade which can delay advanced course-taking or even access to the Governor’s School. The change progress has opened the doors wider for more students to access Honors and advanced classes at the middle school level. School leaders may need to reconsider approaches for students to access Geometry classes so accelerated learners in this district can compete with students outside the district to access advanced learning opportunities at the high school, Governor’s School, and beyond.

**Change management process.** According to the administrators and teachers, the change in enrollment processes and criteria at Rose Middle School, which impacted student access to advanced mathematics classes, came in response to the revision of the 2009 state mathematics standards. This led to a four-year period of implementation of a challenging curriculum and rigorous assessments at the district and school level. With the rippling effect coming from the State level, Rose Middle School made efforts to move beyond the “status quo” and implemented changes in enrollment processes and procedures that required a “reshaping and mounting of a structured process” (Bryk et al., 2010, p. 18). Therefore, change, in this instance, may be considered a structured process that involved key stakeholders, which positively influenced

Black students' enrollment in advanced mathematics classes even though it was not purposefully planned with that specific end in mind.

**Change in enrollment criteria.** Policies and school practices are an important consideration because, while schools cannot change factors outside the school, they can change their own policies to enhance Black student participation in advanced courses (Adelman, 2007). The present study shows that the criteria that schools use to determine eligibility for student enrollment in advanced mathematics classes should be examined extensively whenever there are concerns about the levels of Black student enrollment and achievement (Adelman, 2007; Riegle-Crumb & Humphries, 2012; Walker, 2007). Policies that lift all students will also have a positive effect on Black students.

In this case, student enrollment in advanced mathematics classes, especially at the sixth grade level, increased over a four-year period due to changes in enrollment criteria. The study participants gave much consideration to Grade 6 enrollment criteria, most likely because Grade 6 is the starting point where students first experience mathematics placement based on standardized testing and other criteria. Moreover, the data and class roster documents suggested that Grade 6 placement is important because some students stay at that same placement level throughout middle school, even though course placement decisions are evaluated each school year (GC1, 6-2).

Data from this study support the findings from Holt and Campbell (2004), who examined the effects of school policies on mathematics achievement as students transitioned from middle to high school. They found that school policies could either improve or hinder achievement for students, thereby “closing [or widening] the achievement gap between racial majority and minority students” (Holt & Campbell, 2004, p. 2). In this instance, changes in enrollment practices and policies tended to increase student access to advanced level math classes; however, there were some concerns about elements of those practices, such as teacher recommendations and the types of data, used to determine eligibility. Teacher recommendation concerns will be fully discussed under “Perceived Barriers”.

An unexpected theme that emerged was the concern that a norm-referenced mathematics assessment was not given to all students prior to entering Grade 6 and was not used as one of the criteria for enrollment. Some study participants felt that this type of assessment would help to target those students who showed strong potential to achieve in advanced mathematics classes.

There are a few possibilities of how this initiative may support student access to such classes. If the goal of schools is to increase access to advanced classes, especially Black students, then norm-referenced testing may be a practice that the district considers along with other measures to determine students' level of performance (Hidden curriculum, 2014). The key is that norm-referenced testing along with other measures may minimize biases or beliefs which may enter into students' access to advanced level classes (Ford & Scott, 2010). The present study acknowledges that norm-referenced testing can be problematic. First, funding to support such an initiative for all students may be an issue since many districts are facing budget constraints. Secondly, there is an on-going debate in some educational institutions about the validity and fairness of norm-referenced testing (Hidden curriculum, 2014). The debate seems to be centered on whether a single factor should be used as a primary indicator of enrollment in advanced classes, which is not the case at Rose Middle School. More importantly, the benefit of norm-reference testing in this instance may cast a wider net to identify more children who possess the fundamental skills to enroll and succeed in advanced mathematics classes. Norm-reference testing might support the expectation that a proportional representation of Black students are enrolled such classes. The present study acknowledges the use of multiple factors for enrollment considerations in order to minimize biases and other hindrances that might impede student access.

**Communication resources for enrollment criteria and procedures.** In the study, communication was a central theme that emerged often in different categories of analysis. This particular category dealt with how students, parents, and extended community were informed about enrollment processes and criteria for advanced mathematics classes. The findings supported the observations in the existing literature that schools can enhance student achievement through deliberate actions, which include the efforts the school makes to engage families in practices and processes (Bryk et al., 2010). Consistent with the literature, the data revealed that Rose Middle School had multiple ways of engaging and informing families about mathematics processes and procedures. The course guide, course offerings information, registration timeline, and parent information nights created an informational link between key stakeholders and the elementary schools that helped relay information to rising sixth, seventh, and eighth graders and their families.

*Rose Middle School course guide and course offerings.* Beyond providing students and families with information about course offerings, enrollment practices, and enrollment criteria, the course guide also laid the foundation for expectations at Rose Middle School. Even though the course guide was clear and left little room for interpretation about expectations for enrollment in mathematics classes, one of the study participants (A3, 4-29) wondered if parents reviewed the information in order to anticipate requirements for the classes that could impact a child's access to advanced mathematics classes. On the other hand, some felt that the course guides added another dimension in that, "...understanding the enrollment criteria may encourage more parents and students to work at a different level to access such classes" (A1, 6-6). Just as Lee and Bowen (2006) suggest, schools helping parents become knowledgeable about processes was a strong indicator for students' access to certain classes.

*The Registration Timeline.* The Registration Timeline supported efficiency and effectiveness. The Registration Timeline was not shared with families; however, it was designed to keep staff at the middle school, and staff at the 12 feeder elementary schools, consistent in their processes, which in turn impacted students and families. The Registration Timeline provided essential information that kept everyone abreast of critical dates and other essential meetings and deadlines. The elementary schools used the Registration Timeline to inform them of when to send information to rising sixth grade families. In other words, the Registration Timeline was part of the organizational structure.

Bryk et al. (2010) speak directly about organizational structures and how structures can impede or enhance student achievement, noting that the school is an "organizational system with subsystems that interact with one another to create a system conducive to learning" (p. 50). Rose Middle School used the Registration Timeline as a means to foster interactions between various subsystems in the school and within the District. This helped create an environment conducive to learning by helping various people and groups to navigate the enrollment process.

*Rising Grade Level Parent Information Night.* Similar to the course guide that was sent home, Parent Information Nights were another avenue for informing families about course selections and enrollment criteria. These meetings were heavily attended, which shows the families' interest in their children's education. As the literature indicates, families may want their children to take advantage of advanced mathematics classes, but may not know how to articulate that they do not understand the information that they have been presented (Ferguson, 2007;

Walker, 2007). This lack of understanding may be reflected in Black student achievement patterns in school, particularly lack of parental understanding of the enrollment criteria (Steel, 1997).

Rose Middle School used various means of communication to inform families and to provide direction for enrollment processes and criteria. The present study suggests that the communication resources were beneficial; however, participants still indicated a communication gap. Participants questioned whether families reviewed the information, because failure to do so can negate a student's access to advanced mathematics classes (Hornby & Lafaele, 2011). Perhaps, though, the problem is not only whether families review the information. There may be issues with the presentation of the information, too. For example, as participants suggested, perhaps Rose Middle School could hold more than one Parent Information Night for each grade level. Moreover, as one study participant stated, "if the parents do not come to the school; the school needs to come to them" (A1, 6-6).

As the literature indicates, "the Black church continues to hold the allegiance of large numbers of African Americans and exerts influence over their behaviors" (Billingsley & Caldwell, 1991, p. 2). This study found, just as in previous research (Bryk et al., 2010; Herndon & Hirt, 2004), that the church is an important means to reach families. In accordance with the literature and study participants, since the church is still seen as a means to reach Black families, the church could be utilized to help inform families about course taking and enrollment procedures. The school might hold Parent Information Nights at various locations around the district, including churches. In light of previous research that has argued that a student's background is the most important factor in predicting achievement (Coleman et al., 1966) -- later refuted (Edmonds, 1979) -- families' negative experiences with schools may hinder them coming to the school and accessing information. Going out to the community churches might offer a sense of comfort and stimulate more conversations about enrollment criteria and success in advanced mathematics classes.

In summary, the initial change process took a concerted effort at the district and school level. For school practitioners who are considering how to increase efforts to enroll and support Black students in advanced mathematics classes, this study suggests that the effort begins with offering all students a challenging curriculum, rigorous assessments, and related activities. Offering a challenging curriculum with related assessments was the beginning of the change

process. More importantly, the effort also included reviewing enrollment criteria, procedures, and how information is communicated to families about enrollment criteria and course offerings. The impact of school policies and practices is a critical consideration in creating a school environment that strengthens access to advanced courses.

### **Cultural Shift towards Increased Rigor**

Brosnan, Schmidlin, and Grant (2013) noted that nurturing students' mathematics achievement is a challenge for educators. In this study, the road to offering all students a challenging curriculum began with a cultural shift involving revising curricula, revising rigor of instruction and assessments, and revising related mathematics activities. The data suggest that the greatest cultural shift was setting the commitment to providing all students access to a challenging curriculum, regardless of the level of the mathematics class, which encouraged them to "solve multi-step problems and build critical thinking skills that include explaining, writing, and interacting with real world situations" (A1, 6-6).

The culture of rigor is important to success. Ellington and Frederick (2010) conducted a study to identify predictors of success for high-achieving Black college students. One of the primary predictors was having access to challenging mathematics curriculums beginning with their enrollment in elementary school. The findings of this study, together with Ellington and Fredericks' (2010) study, suggest that students who have access to a challenging curriculum achieve higher than those students who do not. While creating a culture of rigorous teaching and learning, the state encouraged districts and schools to make changes from the status quo of typical practices and to restructure to meet the needs of all students (Lee & Smith, 2001).

**District and school expectations and practices.** The framework offered by Bryk et al. (2010) suggested that a process of change [such as that intended by the 2009 Revised Mathematics Standards (VDOE, 2013)] require two stages: first, in the initial stage, attempts to change the status quo were mounted, and then, "roles, responsibilities, and rules [were] reshaped" (p. 18). In this study, at the second stage, effective practices and strategies were essential in providing the support needed to help align with the revised state mathematics standards and assessments. The study participants gave voice to the numerous supports that the district office provided to help align the mathematics curriculum, instructional strategies and assessments, and other mathematics initiatives. The findings suggested that the district, when confronted with the need to act as a change agent, evaluated the role each person in the school

played. The district, in conjunction with the school, developed a plan of action that resulted in implementing practices that aligned with the rigorous curriculum standards and challenging assessments from the state level. These actions also supported one of the 2012-2013 school-wide goals which aimed at enabling students to meet or exceed state guidelines for mathematics achievement thus supporting enrollment and achievement in advanced mathematics classes.

The findings in the data also highlighted the interdependence between the district office and Rose Middle School. The interdependency developed as part of the central focus on giving all students access to a challenging curriculum, best instructional practices, and standards-based assessments, which Tate (2005) suggests is the catalyst for mathematics achievement. This finding supported a previous study (NRC, 2010), which found that schools that provided students challenging mathematics opportunities and supported students' understanding and application achieved higher than those schools that did not.

*Revision of curriculum and assessments.* Rose School District was committed to providing schools with staff development, curriculum development, and resources to improve mathematics achievement for all students. Accordingly, the rigor of the mathematics content was increased in response to the demands of state assessment. At the same time, instructional practices and assessments were revised to align with the standards-based curriculum. Offering all students a challenging curriculum was a cultural shift that involved extensive planning, which included revising curricula to increase rigor in the delivery of instruction and revising assessments that included the process standards that encouraged high levels of thinking. Study participants believed the district and school initiative to align Grades 6-8 mathematics curriculum and assessment with the rigorous state standards impacted students' mathematics achievement, thus impacting enrollment in high-level mathematics classes.

*Process standards.* Most experts in the field of mathematics agree that computational and process standards cannot be separated and that educators must focus on the "relationships, connections, and intersections between the standards to deepen students' understanding [and application]" (Mirra, 2003, p. 7), especially for the most disadvantaged students. One of the overriding premises in this study was that mathematics proficiency at the advanced level requires students to use interwoven skills to solve challenging problems. Since 2009, state mathematics standards have been revised to include the process standards. Beyond problem-solving and making connection to real life situations, these standards require students to explain and write

about mathematics solutions. Therefore, there is now a strong connection between students' computational ability and their ability to solve challenging mathematics problems and explain in writing how they reached their solutions. Similar to the NCR (2002), this study suggests that memorization of facts is not enough to support learning at the advanced levels. Rose District and Rose Middle School's efforts to increase rigor in the curriculum and instruction support students' ability "to apply concepts, to reason, and to see math as useful" (NCR, 2002, p. 12)

*Elimination of low level classes.* The elimination of low level classes was viewed overall as a positive strategy that the district and school used to increase rigor in the classroom and increase student access to a diverse group of learners. The National Education Association (NEA) supports the elimination of low-level classes. The NEA asserted that there are no benefits to these classes, and these classes tended to group together poor and minority students who are than less likely to receive quality instruction (NEA Resolution B-16, 2005). As further reasoning for eliminating low-level classes, in "Challenging Limiting Assumptions: High Quality Mathematics for Underserved Students," Erica Walker (2006) stated,

When we consider instruction, then, it is imperative that we note that teachers' beliefs, knowledge, and attitudes about the subject matter and how to teach it are filtered through their beliefs about students and their potential. Providing equitable instruction for students will require that all of us... examine, and address the embedded relationships between what is done in the classroom and our expectations of students, their performance, and their possibilities. Without this work, equity will continue to elude underserved students. (p. 78)

Even in this study, some questioned the reasoning for eliminating low-level classes. Reality is, low-level classes tend to impact teacher beliefs and can impact decision-making about mathematics content and level of instructional rigor, thus impacting students' ability to learn mathematics (Ford & Scott, 2010; Walker, 2006). The greater emphasis should be placed on all students having access to a challenging curriculum, related activities, and rigorous assessments that support mathematics intensity and preparation for advanced classes.

**The role of school leadership.** Strong leadership by the school Principal was a theme that emerged often among the study participants. This is not surprising, as Bryk et al. (2010) identified the Principal as the school anchor for school improvement. Similarly, Stronge, Richard, and Catano (2008) found that school leaders impacted student achievement indirectly by influencing the teachers who directly impacted student achievement. Other researchers have

contended that few, if any, schools produced high mathematics achievement results without the support and commitment of strong school leaders (Leithwood et al., 2004; NRC, 2010). This study adds to those findings by fleshing out just what a Principal can do to encourage high mathematics achievement.

The Principal of Rose Middle School initiated school-wide practices that improved teacher effectiveness, provided support systems, encouraged data analysis, and built a culture of continuous learning that positively influenced students' mathematics achievement and access to advanced classes. The data showed that these efforts had an effect on the participation of Black students in advanced classes. The Principal was committed to improving mathematics achievement levels, thus impacting students' opportunities to enroll and be successful in advanced mathematics classes.

Schools can become involved in so many initiatives that the original goals and visions can quickly fade. The findings from this study suggested that the school leaders kept the school focused on what was important for the implementation of the revised mathematics curriculum and increasing student enrollment and achievement in advanced mathematics classes. This study suggests that strong school leadership played an especially important role in mathematics achievement and student access to advanced learning.

*Visibility.* Administrators' high visibility was noted as a catalyst for building a culture of trust. Edmonds (1979) argued that effective schools created environments where all children could learn regardless of backgrounds and the staff was held responsible for student achievement. Similarly, the results of this study demonstrate that schools that positively impact student enrollment and achievement in advanced classes have strong leaders who are visible and hold everyone accountable for teaching and learning. Even greater, researchers suggest that a student's greatest chances for academic success happens in the classroom (Mirra, 2003) and as one study participant (A3, 4-29) declared, "...visibility is the key to making sure we see what we are seeing and making sure we know what the teachers and students need".

Therefore, school leaders must work to build trust and accountability among the staff because no leader can do the job alone (DuFour, DuFour, Eaker, & Many, 2006). Trust and visibility are interwoven. Visibility is the basis for building relationships and communicating with the school community about expectations and monitoring those expectations, as study participants declared (T4, 6-4; T5, 5-30). For example, there was an expectation that

administrators would conduct weekly walkthroughs to monitor teaching and learning. Several of the study participants suggested that visibility promoted classroom engagement and teacher effectiveness. In short, trust was built over time with the positive interactions of the adults and students in the school, which also encouraged a culture of high expectations.

### **Culture of High Expectations**

Previous researchers have found a positive relationship between high expectations and student achievement (Cornelius-White, 2007; Ferguson, 2007; Hattie, 2009). At Rose Middle School, administrators, guidance counselors, and teachers reported that holding high expectations was an essential practice that contributed to students' mathematics achievement. Their high expectations provided students with opportunities to work toward their potential. Working toward their potential created favorable learning conditions for students, even though, as one study participant explained, it:

...doesn't mean that it is easy. [They] have to work but there is much gratification when [they] realize their potential. We tell students you can do this, you are going to do this, and it is not about today, but really long term. (GC2, 4-29).

High expectations began with the Principal, who set the tone in the school by holding high expectations for the school staff, and then expecting that all students will achieve at high levels (Cotton, 2000; Edmonds, 1979; Ford & Scott, 2010). The school worked to develop a standards-based curriculum, provided all mathematics teachers with quality professional development in mathematics techniques and strategies, and created common assessments that aligned with state standards. This resulted in "greatly reducing the variation in teacher expectations from one mathematics classroom to the next" (Reeves, 2009, p. 87). Even though the results of these findings are not surprising, it is still important for school leaders to set the tone that all students will achieve at a high level in order to reduce the academic achievement gap and to encourage enrollment in advanced mathematics classes.

*School-wide expectations.* Spielhagen (2006) argued that educators should consider equitable opportunities that provide access to performance tasks that ask students to explain, solve, and write, which may support Black students' experiences in gaining mathematics proficiency. This study identified classroom practices and strategies at Rose Middle School that were found in other studies to be best practices (Cotton, 2000; Daggett, 2005; Marzano, 2003; NCTM, 2002; Reeves, 2003; Waters et al., 2003), including exposure to a standards-based

curriculum and assessments, data analysis, WIN support, and high expectations. In other words, there was an expectation that all students would have access to performance tasks and challenging problems that were part of a well-structured learning environment. Students were exposed to tasks that challenged them, which will eventually support the skills needed to take advantage of advanced level classes. The central finding is that, regardless of the level of the mathematics class observed, honors, high, or average, all students had access to rigorous instruction. Similarly, previous researchers argued that “[schools] must identify and implement practices that are critical to student success” (Cotton, 2000, p. 7).

*Student-teacher relationships.* The quality of student-teacher relationships emerged as an important theme among study participants. Both the findings of this study and previous research suggest that when teachers work to build a positive climate and strong relationships with their students, these same students were more likely to be successful (Casteel, 2000; Cornelius-White, 2007; Darling-Hammond, 2005; Hoover-Dempsey & Sandler, 1997). The findings in this study related positive teacher-student relationships to students’ math achievement, since students may relate teacher behaviors and expectations to a positive and caring learning environment (Hattie, 2009) and work to meet expected levels of mathematics achievement. The study participants spoke volumes about the impact positive relationships have on student achievement. The emphasis here is that teachers’ behaviors and encouragement may help to improve Black student enrollment in advanced mathematics classes for those who may be hesitant to take qualifying assessments to determine eligibility to enroll in such classes. This study is not suggesting students should not meet criteria eligibility, but only that students should have access to rigorous tasks and challenging curriculum and instruction to support and encourage eligibility in advanced mathematics classes.

Encouragement for those students who are not enrolled but should be enrolled through eligibility may be a key ingredient to increasing Black student representation in advanced classes (Adelman, 2007). In support of this contention and this study’s results, Walker (2007) found that students were more likely to be successful when their teachers provided encouragement and supported their mathematical goals. Furthermore, Frome and Dunham (2002) found that the more guidance and encouragement Black students received from teachers, the more likely it was that those eligible students enrolled in advanced classes. In the words of T5 (5-30),

We have to structure so that every kid can rise to the level that they can rise to. That we don't impose this notion about what people can do. We need to eliminate barriers as best we can...sometimes we need to reach down and tell a kid you can do this...you have greatness in you.

Finally, this study suggests that positive teacher-student relationships and encouragement are interwoven factors that promote student achievement, especially for the most disadvantaged students.

*Assumptions about Black students in advanced classes.* When asked what the school could do to encourage Black student enrollment in advanced classes, a surprising category that emerged from the data was assumptions about Black students in advanced mathematics classes. When asked about the support that was provided to Black students who were enrolled in advanced mathematics classes, the response was that “the reality was Black students who [were] enrolled in advanced mathematics classes did fine and did not need support, similar to their White peers” (T2, 4-28) who did not need support. It must be noted that study participants’ use of the term support in this instance referred specifically to academic support such as tutoring or remediation. In other words, respondents challenged the assumption in the question – that Black students needed extra supports that their White peers did not. Rather, Black students were assumed to be equally capable. It makes sense that Black students in honors classes do not need more support than White students, since the strongest students are in the honors classes. Perhaps this suggests that thinking about Black students in terms of remediation is no longer necessary when those students are given the same opportunities for enrollment, and immersed in the same culture of rigor and high expectations as their White peers, from their earliest experiences in mathematics classes.

The findings in this study suggest, however, that there was a need to provide some Black students with home level support: completing homework was a recurring theme. There were contrasting views among study participants about the need for support with completing homework and other assignments. Teachers were more likely than guidance counselors and administrators to say Black students needed additional support beyond tutoring. They all agreed that Black students were less likely to withdraw from an honors class because of ability to achieve. Conversely, they also agreed that Black students were less likely to enroll in advanced classes for various reasons. Therefore, an argument could be made that since the teachers serve

the students on a daily basis and “get to know the students really well” (T4, 6-4), they may be knowledgeable about what students may need in order to enroll and achieve at the advanced levels. In this instance, the teachers’ observations, opinions, and experiences about students’ ability levels can play a role in helping students access advanced learning. However, the problem herein may be that some teachers carry assumptions into the classroom that negatively impact achievement as previously discussed. Therefore, professional development opportunities that address “educational equity for all students are important as [schools] strive to remove barriers to educational opportunities [especially] for [Black] students” (Hidden curriculum, 2010, para. 2). Here again, educating stakeholders is seen as a means of addressing and correcting negative assumptions to ensure that beliefs positively impact student enrollment and achievement in advanced mathematics classes (Darling-Hammond, 2007; Ferguson, 2007; Ford & Scott, 2010; Spielhagen, 2010; Stewart, 2008). Certainly, teacher input cannot serve as the single factor or avenue to advanced classes, but it may be used along with other factors as a lens to see beyond the students’ background, behaviors, or family dynamics, which some researchers posited are hindrances to enrollment in advanced classes (Spielhagen, 2010). At some point, practitioners must begin to ask why and seek solutions to Black student underrepresentation in advanced classes. As the study participants noted and the literature on minority student achievement has indicated (Boykin & Noguera, 2011; Darling-Hammond, 2007; Edmonds, 1979; Ladson-Billings, 1997), Black students are capable. Therefore, school leaders, teachers, and staff must know the students and their needs in order to enroll and sustain student access to advanced learning (Walker, 2007). Along those same lines, the district and school must face the reality that negative beliefs may exist. Thus, making concerted efforts to improve values and beliefs about people from different races, cultures, and economic levels are important to increase student enrollment and access to advanced mathematics classes.

### **Culture of Continuous Learning**

Building the professional capacity of staff members supported student achievement, which is consistent with the findings in the literature (Bryk et al., 2010; Reeves, 2003; Waters et al., 2003; Whitehouse, 2009). Professional capacity included not only aligning the mathematics curriculum with the delivery of instruction but also attending to professional development and continuous improvement, which Bryk et al.’s (2010) framework suggests is an essential component in promoting students’ mathematics achievement. Reeves (2003) also indicated that

educators should focus on how to implement a rigorous curriculum in order to impact student achievement. In this study, a culture of continuous learning emerged from the data as an important category. In partnership with the district, the school identified and implemented practices and strategies that supported staff effectiveness, which supported student mathematics achievement. Administrators and teachers alike were expected to develop the proficiency to support mathematics achievement.

**Administrators' professional development.** One of the most noteworthy findings was that the administrators did not work in isolation from the teachers. Just as the teachers were involved in intensive staff development, so were the administrators. It was essential that the administrators were able to recognize effective mathematics instruction and related activities. There was not an assumption that administrators had the skill set to perform effective monitoring of mathematics instruction. The data indicated that administrators attended workshops that focused on effective mathematics instructions. As Reeves (2010) noted:

The systematic focus on effective leadership that is designed to maximize the impact of teaching on student learning must emphasize neither evaluation nor a fire hose of content. Rather, leaders must be the architects of systems and schedules that lead to professional learning... Leaders' focus begins with processes for effective feedback to support instruction. (p. 70)

Since the teachers were involved in professional development opportunities to increase the quality of instructional delivery, the administrators had the responsibility of providing feedback to the teachers about the strategies that were being implemented (T1, 4-28). Therefore, this study supports Bryk et al.'s (2010) position that professional capacity and instructional support have strong ties to students' mathematics achievement. Rose Middle School implemented many practices that supported the implementation of a challenging curriculum and teacher development. The school practices aligned with the district practices, and as Bryk et al. (2010) suggest, "a creative yoking of these perspectives might actually be quite beneficial" (p. 47). Finally, this research indicated that school practices both directly and indirectly impact students' mathematics achievement at various levels, and in turn, this impacted access to advanced mathematics classes.

**Teachers' professional development.** Daggett (2005) stated that preparing teachers and administrators to meet the demands of a rigorous curriculum seemed to be the link to student preparation and achievement. The literature on teacher effectiveness contends that:

Although teachers have an undeniably large influence on student results, they are able to maximize that influence only when they are supported by school and system leaders who give them the time, the professional learning opportunities, and the respect that are essential for effective teaching. (Reeves, 2010, p. 70)

This study supports this claim. At Rose Middle School, teacher preparation was essential to increasing students' access to a rigorous curriculum and related activities. Relationships between teacher preparation and other categories were noted, as well. Teacher preparation seemed to link to the interpretation of the revised standards, which was in turn linked to development of the curriculum, instructional practices, classroom practices, and beliefs about student access to advanced classes. In accordance with Darling-Hammond (2007), this study found that teacher preparation and student achievement were closely interwoven. As Darling-Hammond (2005) noted, student access to qualified teachers has an impact on students' acquisition of mathematical skills, which impacts their access to advanced classes. A teacher's instructional capacity is also an important feature in the framework developed by Bryk et al. (2010).

One of the essential factors for increasing student achievement and enrollment in advanced classes at Rose Middle School was the attention given to increasing teacher capacity to present instruction at the rigorous levels needed to meet the demands of the state mathematics standards as well as to a diverse group of learners. To support this contention, Walker (2006) stated,

Excellence in mathematics instruction requires attention to both *macro* curriculum and organizational issues as well as *micro* teaching and learning. Excellent teaching has never been solely defined as the ability to work well with students who have had every advantage. The true test of good teaching should be reflected in a teacher who can teach students in such a way that they excel in mathematics – despite what the teacher and others may see as limitations in students' home lives, and despite what is seen as a lack of motivation. There should not be the expectation of a “magic bullet” curriculum – again, recognizing that teachers and students are active agents in the instructional process. (p. 77)

Data from this study supports this assertion, as for example, when A1 (6-6) assessed that “the problem was not the increase in rigor of the assessments; the problem was building increased levels of instruction.” Teacher capacity was built over time to provide all students with challenging learning experiences; therefore, “teachers were at a different level of understanding than when the change process started” (A1, 6-6).

Teacher capacity was also built laterally, between and among teachers. The math teachers at Rose Middle School did not work in isolation, but instead, worked together to make sure that each teacher understood the standards and had resources to plan lessons, monitor instruction, and assess students’ understanding of the objectives (A3, 4-29). The findings in this study support earlier studies (Darling-Hammond, 2005; Stronge et al., 2007) that have suggested that providing students with a challenging curriculum and related activities is the main work of teachers and that the key to good mathematics instruction depends upon the skills of the teachers.

At Rose Middle School, the classroom teachers had received intensive staff development over the course of the four years since the implementation of the revised state standards. Similar to the work of NCTM (2005), the findings in this study suggested that classroom strategies included exposure to tasks that helped students think critically when applying mathematics concepts to real world situations. This study found that the quality of classroom practices and teacher capacity supported mathematics achievement even though some study participants had contrasting views, which will be discussed under the “Perceived Barriers” section.

The data suggest that building a culture of continuous learning over time increased teachers’ instructional effectiveness, thus positively influencing students’ access to effective mathematics instruction. Maurer and Weiss (2010) indicated that a culture of continuous learning presented certain attributes: an ability to learn new things readily, taking the initiative to learn, and working to improve areas of weaknesses. At Rose Middle School, the culture was shaped by specific school practices and data sharing. As one study participant stated:

I think that three things are provided very well...the first thing is feedback from our administrators in and out of classrooms. Opportunities to collaborate with other teachers...administrators supported that idea [collaboration]...offered opportunities for ways to become a better teacher. (T1, 4-28)

As Sessa and London (2006) suggested, continuous learning is a natural process; however, such learning has to be initiated and supported. Another factor that may contribute to student enrollment in advanced classes is school-wide data practices.

## **Data Sharing**

**School-wide practices.** The culture of Rose Middle School was built around data-driven decisions. Even though data-driven initiatives are closely connected to the strength of the school leadership, Schmoker (2006) stated that effectively using data to guide practices and instruction is an effective way to manage and monitor student learning. It is worth noting, though, that there is some discussion in the research literature about whether frequent monitoring of student achievement has a positive effect (Leithwood & Seashore-Louis, 2011). Implementing this collective initiative required staff development and a common language that was a natural part of the school. However, the downside to a school's use of data, as the literature suggests, is that a school can have vast amounts of data available to it (Trimble, 2002) and lack the skills necessary to use the data effectively. In the school's attempt to limit "data rich but information poor" (DuFour, DuFour, Eaker & Many, 2006, p. 215) situations, Rose Middle School was selective in its data use, and focused on state assessment data, benchmark data, and demographics to support student achievement and instructional effectiveness and provide staff development. The findings in this study suggest that staff development on effective data use, frequent monitoring of data, and using systematic approaches, do have a positive impact on adjusting instructional delivery and providing students' with additional academic mathematics support and enrichment opportunities.

**Remediation and extension activities.** Remediation and extension activities can impact students' access to advanced mathematics classes. For example, it was an expectation that administrators and teachers monitored student achievement, using various sources of data, to provide students with support and to adjust instructional practices (T6, 6-10). Beyond data use as a tool for remediation, analysis of the data notified administrators and teachers if or when students were misplaced in mathematics classes or needed extension activities to meet students' needs. The classes were designed to meet the needs of the students at varied levels.

In summary, if schools expect to improve access to advanced mathematics classes, then they must know what is currently happening instructionally and academically. Rose Middle

School used current data on assessment, teaching, and learning to adjust instructional practices and if necessary, place students appropriately. In accordance with Leithwood and Seashore-Louis (2011) suggestion, data use was a collective effort at Rose Middle School among school staff in order to increase mathematics achievement, thus impacting enrollment and achievement in advanced mathematics classes.

### **Perceived Barriers to Enrollment**

While students having access to a challenging curriculum has surfaced as being critical to closing the achievement gap and improving future educational and job opportunities (Achieve, 2008; Spielhagen, 2010), Black student access to such classes remains limited. Research indicates that there are many advantages to enrolling in and completing advanced mathematics classes (Spielhagen, 2006). This study found that Black students could do the work in such classes when they met established enrollment criteria, enrolled in the classes, and provided support for completing homework or class assignments to those who needed it. This study's findings suggested, though, that there were some perceived barriers that hindered Black student enrollment in advanced mathematics classes.

The third research question for this study examined the relationship between student enrollment and achievement in advanced mathematics classes and the factors that may impede enrollment in such classes. The body of literature surrounding minority student achievement (Azzam, 2008; Lee & Bowen, 2006; Ogbu, 2003; Orr, 2003) suggests that any number of potential barriers, including socioeconomic status (Azzam, 2008), student effort (Hattie, 2003), school policies (Adelman, 2007), and high poverty schools (Aud et al., 2010) tend to burden mathematics achievement. In this study, similar perceived barriers were noted: communication, school practices, teacher practices, and cultural barriers.

**Communication.** In this study, communication was a recurring theme that emerged across different categories. The findings in this study were consistent with the body of research that suggests that communication between home and school is crucial to student achievement (Edmonds, 1979; Jeynes, 2007; Lezotte, 1990). Study participants felt that communication between home and school contributed to student enrollment in advanced classes. Even though the school used multiple ways to communicate with parents about enrollment processes, study participants were concerned about the level of communication and felt that the parents should be

more involved in the enrollment process. Developing and maintaining good communication techniques between the school and home were reported most frequently by study participants as an area that the school needed to improve that could possibly affect student enrollment in advanced level classes (Walker, 2007).

The literature is very clear in stating that what parents believe, know, and do not know can impact their children's education (Hoover-Dempsey & Sandler, 1997; Morrison-Gutman & McLoyd, 2000; Walker, 2007; Warner, 2010). When asked, what were potential barriers that hindered access to advanced mathematics classes at Rose Middle School, the most common response was the level of parent involvement. According to Bryk et al. (2010), parent involvement is "comprised of two measures: the school's outreach to parents and the parents' involvement in the school" (p. 72). However, personnel at Rose Middle School were more concerned with a different dimension – whether parents understood the information that they were receiving and how to act on it. Some of the study participants felt that the school needed to use innovative ways to reach parents about enrollment processes and criteria. Several participants suggested that if the parents did not come to the school, the school needed to go to the parents. Several study participants even went as far to suggest that the church was an avenue that should be utilized to speak with Black families since some families attend church. Study participants' concerns echoed those of Jeynes (2007), who stated that parents' understanding of practices and processes may help to reduce the academic gap that exists between White and Black students. The findings in this study are consistent with findings in other studies that examined parent involvement, suggesting that it is imperative for schools to develop partnerships with families and communities if the aim of schools is to increase student access to advanced classes and reduce the achievement gap (Blankstein & Noguera, 2010).

**School practices.** Even though Rose Middle School had implemented numerous changes that impacted student enrollment and achievement in advanced level classes, the data indicated that some of the practices at the school level were perceived by study participants as barriers affecting student enrollment in advanced mathematics classes. In contrast with the perceived enrollment, curriculum, and assessment changes, the researcher found that consistency with enrollment processes, scheduling practices and time, teacher preparation, and cultural beliefs continue to hinder enrollment and achievement in advanced mathematics classes.

*Consistency with enrollment practices.* The guidance counselors reported more frequently than the administrators that maintaining consistency was critical to enrollment practices. In this study, the guidance counselors tended to work more closely with enrollment criteria and voiced more concern about whether students were placed appropriately and about teacher recommendations. When asked about barriers at the school level, one respondent stated, “sometimes teachers do not recommend students who may be able to do the work. We need to look at the written criteria whether [the student] is minority or not. Policy can be a barrier.” This response was not common among study participants. More common was the comments about parents’ lack of knowledge about enrollment criteria and teachers inconsistent use of the teacher rating form (see Figure 2 and Figure 3) which may lend themselves to some inconsistencies with enrollment practices. Ensuring consistent scoring when making recommendations for such classes may require some attention. Here again, the only way to do this is to make sure everyone is educated about enrollment processes and procedures: (e.g., completing teacher rating forms).

To support this view, in her eight year study examining practices at a middle school that transitioned all eighth graders to the study of Algebra, Spielhagen (2011) suggested that the goal of consistency across all schools should include staff development on school level practices to ensure consistent implementation of processes. The data from this study did not indicate if mathematics teachers had been involved in staff development about enrollment criteria and appropriate use of teacher recommendation forms. Based on the data, the school did seem focused on the written criteria of collecting the different measures; the larger problem may be the use of subjective information from a single factor that may hinder student enrollment and achievement in advanced mathematics classes. However, it is important to note that, Michael Bolling, current Director, Office of Mathematics and Governor’s School, Virginia Department of Education, supported the idea that change does bring “a myriad of implementation challenges...but change [is] necessary to provide equity of opportunity in the face of obvious opportunity gap” (as cited in Spielhagen, 2011, p. 83). Similar to the findings in this study, Lee (2004) suggested that “schools needed to be watchful of potential policies and practices in their efforts to address the [mathematics] achievement gap” (p. 52) may hinder access and opportunity.

*Environmental factors.* There were environmental factors at the school level that the study participants indicated were barriers affecting enrollment in advanced mathematics classes:

class offerings, scheduling practices, and time factors. There were contrasting views about class offerings. One study participant identified class leveling and the time of day these classes were taught as barriers. She felt the math classes designed for struggling learners should be during the morning hours, which may, in turn support students' achievement. In contrast, another study participant felt the class offerings and schedule met the diverse needs of the students. Even further, time spent on mathematics instruction was examined as the school needing more time built in the schedule to meet the needs of students and teachers, even though over the previous four years the master schedule had been adjusted to provide more time for mathematics remediation and extension activities. Interestingly, even though study participants implicated time as a barrier, some believe that the size of the school heavily impacted the way in which time within the school day was designed. Beyond time and scheduling, the greater obstacle may be how the teachers use the allotted time to support active mathematics learning. Students may need more time to discuss problem-solving techniques and get individual attention from the teachers. The teachers may need additional time to model problem-solving, have students explain their mathematics processes and engage in critical thinking activities.

According to Hofmeister and Lubke (1990), "efficient and effective use of allocated and engaged time can significantly increase the amount of time that students experience successful academic learning" (p. 1). To tie all this together, Bryk et al.'s (2010) framework emphasized that it takes time to build professional capacity, student capacity, parent-community ties, and a belief system that everyone can achieve. One guidance counselor noted that, "if a teacher does not have command of [instructional practices] then learning cannot occur." The present study would like to take this thinking one step further and suggest that beyond instructional practices, the implications here may be that (a) effective use of the time given for children to learn mathematics concepts and processes is given, and, more importantly, (b) beliefs about how the time that is scheduled for instruction is used at the classroom level (Darling-Hammond, 2007; Ford & Scott, 2010).

The present study views these environmental factors as less relevant to learning than the instructional level practices, which tend to have a stronger impact on achievement (Darling-Hammond, 2007). Certainly, the environmental factors may interfere with classroom level factors; yet the classroom level is the place where teaching and learning occurs (Bryk, et al., 2010), which may foster the achievement gap and limited access to advanced leveled classes. For

example, if student level factors such as poverty, student ability, and family dynamics are taken into account, then the level of expectations may be lowered reducing the rigor of instruction that is essential for advanced levels of learning (Ford & Scott, 2010; Hattie 2003; Walker, 2007). Therefore, the barriers may lie within the level of rigor and expectations at the instructional level, not necessarily time, grouping, and scheduling, that may be masked as directly impacting achievement (Bol & Berry, 2005; Darling-Hammond, 2005, 2007; Ferguson, 1998; Ford & Scott, 2010; Ogbu, 2003). Along those same lines, other factors may be at work, such as those discussed further in the next section.

*Teacher preparation (effectiveness).* The district and school provided teachers with opportunities to engage in best instructional practices to support implementation of revised standards and grade level curriculums. Yet, some study participants felt the teachers' preparation and effectiveness either inspired the students or turned them off to mathematics. Data indicated study participants referenced teacher preparation with the revised standards and their ability to teach at the level the standards required for student achievement as a crucial component of enrollment and achievement in advanced mathematics classes. The revised K-12 2009 Virginia mathematics standards now include the five process standards (writing, explaining, applying, problem-solving, and making connections), which are closely linked to performance tasks that help students develop a deeper understanding of concepts as well as how to apply them (Cai & Lester, 2010).

Administrators, teachers, and guidance counselors believed that the district and the school have the responsibility to provide continuous staff development and support so that "mathematics could be taught at a very rigorous level of instruction with depth" (A2, 4-28). The greater emphasis here may be that teachers possess varied instructional abilities and may need individualized support (e.g., problem-solving, modeling math problems, or scaffolding performance tasks) in order to meet the needs of the students. Since some researchers suggest that when mathematics classes include performance tasks as a part of each lesson, this not only impacts higher-order thinking skills but also mathematics preparation for advanced learning (Burriss et al., 2004; Cai & Lester, 2010; Levasseur & Cuoco, 2003). Even though the teachers at Rose Middle School received multiple opportunities for professional development, some teachers may struggle with instruction. According to researchers, (Achieve, 2008; Darling-Hammond, 2004, 2005; Darling-Hammond et al., 2001; Ferguson, 2007; Flores, 2007; Hattie,

2003; Pierce, 2001; Stronge, 2007) student access to teachers who are able to teach at the level the standards require has an impact on students' acquisition of mathematical concepts and procedures, which impacts their access to advanced classes.

Further, the Bryk et al. (2010) framework contends that, beyond school-level practices, an important force at work is what happens at the classroom level. The framework is anchored in the notion that school improvement efforts matter when "its effects accrue through influencing the conditions under which teachers work and engage with students around subject matter in the classroom" (p. 47). In other words, the school can provide quality staff development, workshops, and peer collaboration; however, if the teacher does not present students with rigorous delivery of instruction and tasks that help build their conceptual and process knowledge, then the work of the school is in vain.

Therefore, the present study contends that, while teacher qualifications are important, greater importance lies with the teachers' abilities and beliefs to implement effective practices that positively impact mathematics achievement. Hence, effective rigorous mathematics practices then can help to position Black students for enrollment and achievement in advanced mathematics classes. Therefore, as the literature suggests, inadequate teacher preparation and effectiveness can be barriers to mathematics achievement (Adelman, 1999; Darling-Hammond, 2005; Hattie, 2003; Riegle-Crumb & Humphries, 2012).

**Cultural beliefs.** As previously noted, up until this point, the discussions of barriers that seem to impact student enrollment have been at the school level. Some study participants focused on barriers at the student level, such as parental influence and students' academic abilities. These barriers tended to place blame on parents and students as the reasons why some students faced limited enrollment in advanced mathematics classes. Donna Ford and her colleagues call blaming factors other than the school as "*deficit thinking*" (Ford & Scott, 2010. p. 2). Deficit thinking is defined as claiming that the deficiencies of poor and minority groups and their families are responsible for students' school problems and academic failures, while holding educational systems blameless (Ford & Scott, 2010). The present study acknowledges the possible presence of deficit thinking and the implications such thinking can have on enrollment and achievement in advanced mathematics classes.

The present study also acknowledges, beyond the deficit thinking theory, that cultural beliefs may be a barrier to Black student access to advanced mathematics classes. Cultural

implications of academic achievement are documented in the research (Fordham & Ogbu, 1987; Ogbu, 2003; Stewart, 2008). Therefore, it is important to present the findings about cultural beliefs on Black student achievement to help foster conversation in educational institutions as they attempt to support Black student enrollment in advanced mathematics classes. It must also be noted that Black study participants voiced these concerns more often than White study participants did, although one White study participant did voice some concerns regarding those Black students who showed potential for success in advanced mathematics classes and were not enrolled in such classes for various reasons. Even though cultural beliefs may be an uncomfortable discussion for some educators, this is an area that needs attention if schools are to increase Black student representation in advanced classes. One study participant even questioned, “why [aren’t] there more Black students in advanced classes, they certainly can do the work” (T2, 4-28).

An important pattern that emerged during the study was the participants’ perception of the impact beliefs have on some Black students’ academic achievement. The research literature has documented the influence that student level factors have on student achievement, especially among Black students (Darensbourg & Blake, 2014; Stewart, 2008). At Rose Middle School, there was a definite concern for those Black students who showed potential, could do the work, and needed to access advanced mathematics classes (T4, 6-4). The findings in this study suggested that “when schools build a school for all learners... [it was important] to recognize that smartness [is] not always cool in some cultures and some Black students worked to avoid the “nerdiness” among their friends” (A3, 4-29). What is not clear from the data is whose cultural belief is problematic – that is, whether students actually have the cultural beliefs attributed to them or whether the perception reflects the cultural beliefs of the educators.

Findings from this study are interesting in light of the work of Taylor and Graham (2007), who found that Black children at the middle school level tended to have a harder time bouncing back from the decline in engagement and learning during adolescent years than their White peers. This may be interwoven with the issue of school level factors, beliefs, and peer and community pressures. On a positive note, these same researchers (Taylor & Graham, 2007) found that peers can have a positive influence on academics if they share the same beliefs that an education is important to future aspirations. One implication of these findings is local schools may wish to consider activities such as individualized academic advising for all students, but

especially for Black students, that focus on how advanced classes impact college attainment, future jobs, and opportunities.

Minority student achievement is well noted in the literature dating back to the 1966 *Coleman study* that initiated debate about who has the strongest influence on Black student achievement: the school or the family (Azzam, 2008; Edmonds, 1979; Ford & Scott, 2010; Lee & Bowen, 2006; Ogbu, 2003; Orr, 2003), and even though discussions in the literature continue today, the present study and other literature such as the work of Ford and Scott (2010) might be used as a “guide...in [educators’] efforts to effect meaningful change, to correct inequities, and to advocate for minority students” (p. 2). Hopefully, the present study opens the door to more discussions at the district and school level about why Black students are underrepresented in advanced classes so they too may have opportunity for advanced learning, which eventually impacts job opportunities and becoming productive citizens. The present study contends that even though Black students are faced with varied obstacles, schools should work to provide Black students with challenging curriculums and quality instruction so that they too possess the critical skills necessary to enroll and achieve in such classes regardless of beliefs, backgrounds, and expectations.

### **Implications and Recommendations**

The results of this study have practical implications for teachers, counselors, parents, administrators, and policy makers who play a key role in enrolling and supporting Black student access to advanced mathematics classes.

#### **Communication**

*Implication:* Communication between home and school is essential for improving parents’ understanding of advanced mathematics class enrollment criteria. What parents know and are able to do may impact students’ access to advanced mathematics classes. One of the themes that resonated with study participants was communication between home and school. Many of them felt that communication was one area that the school needed to improve.

*Recommendation:* The middle school should foster stronger communication with the elementary schools regarding mathematics classes and enrollment criteria at the middle school level. Teachers are essential to this endeavor, especially Grades 3-5. Middle school personnel

could meet with third through fifth grade teachers to present enrollment information and also to give them information to share with the students. The school leaders could work together to create opportunities for middle school personnel to come to the elementary schools to speak directly with parents about mathematics course-taking and course criteria. Thereby, parents are not just learning this information during middle school parent information nights or through the middle school course guide. Of course, the middle school needs to continue the parent information nights, sending course guides home, and meeting with individual parents to answer questions.

### **Early Assessment**

*Implication:* There are some students who have the potential to perform well in advanced mathematics classes but do not access those classes until they enter seventh or eighth grade.

*Recommendation:* The district could implement a policy to give all rising sixth graders the Orleans Hanna assessment. Giving all students this norm-referenced assessment may highlight students who have the potential to perform well in advanced mathematics classes but are not recommended, do not have an interest, or do not perform well on state assessments for various reasons. The funding for norm-referenced assessments may be an issue.

### **Explicit Discussion of Cultural Beliefs**

*Implication:* There is a concern that Black students have the potential to achieve in advanced mathematics classes, but allow cultural beliefs to prevent them from accessing such classes. Some of the study participants discussed in-depth some of the cultural beliefs that discourage Black students, especially males, from achieving their potential.

*Recommendations:* School leaders should create a program to invite Black students and their parents to speak candidly about cultural beliefs and the impact advanced mathematics classes can have on future opportunities. The school could invite Black college students to come and speak with these students about their experiences. These individuals could be another encouraging voice beyond the school and also serve as role models. Giving these students the opportunity to speak with other students about their concerns may help them become more comfortable with the idea of enrolling in advanced mathematics classes. Also, even though peers have a definite impact on their friends' beliefs and attitudes, positively or negatively, the research suggests that parents still have the strongest influence when it comes to academics

(Taylor & Graham, 2007). Educating parents may increase their understanding of criteria, but more importantly, their understanding of the impact that advanced mathematics classes have on college attainment.

### **Academic Advising**

*Implication:* Academic advising should be a natural part of the middle school experience.

*Recommendation:* For two days out of the school year (one in the fall and one in early spring), all staff members should be required to meet with small groups of students to discuss mathematics course-taking, and more importantly, enrollment criteria. Currently, the guidance counselors do meet with PE classes to discuss the course guide and registration process. It is feared that some students will not ask clarifying questions in a large group, especially in front of their peers. The school should take whatever steps are necessary to make sure all students understand enrollment process and criteria. The positive results might be having more students work harder to reach criteria requirements.

### **High Expectations**

*Implication:* High expectations must be held throughout the entire school so that all students have access to a challenging curriculum, rigorous instruction, and a culture where all students can succeed.

*Recommendation:* The school leader should continue to foster an expectation that average and inclusion students will receive the same instruction and expectations as honors and high level students. School leaders can set expectations for the school using leadership teams and the school improvement goals to put an emphasis on subgroups. Teachers play a vital role in reaching all students because they are their first point of contact throughout the school day. Teachers should be involved in the decision-making process with the school improvement plan and other school and district initiatives that support student achievement.

### **Recommendations for Future Research**

The study reported here was a single case study at a single middle school. The results are informative, but need to be combined with further studies at additional schools in order for a rich picture to develop. Future researchers are encouraged to replicate this study at other middle schools. They are also encouraged to study policies and practices regarding mathematics

achievement at the elementary school level to see if similar findings are described by other principals, teachers, guidance counselors, and math coaches. The questions may need revising to gain the information needed at that level, but the practices and strategies used at the elementary level might link to effective practices at the middle school level.

Another possible research topic is the further exploration of the perceptions of students and parents relating to why more Black students are not enrolled in advanced mathematics classes. It could be beneficial to gain their understanding of enrollment practices, registration process, and enrollment criteria for advanced mathematics classes to understand where adjustments need to be made at the school level. It would also be useful to gain their perspectives on the perceived value of a strong background in mathematics. Their insights might shape suggestions for school leaders in reaching out to more Black parents and families.

Several study participants raised concern about inconsistencies of enrollment criteria, specifically the scoring of teacher recommendation forms. A further study at the middle or high school level might examine and describe the impact teacher recommendation scores have on student enrollment in advanced mathematics classes, especially for Black students. The study could attempt to determine the statistical significance of the impact that teacher recommendation scores along with other criteria have on access to advanced classes.

### **Conclusion**

The findings of this study revealed how one middle school implemented practices and strategies to prepare and support Black student enrollment and achievement in advanced mathematics classes. Walker (2006) argued that, “the middle school years, in particular, mark a critical milestone in the educational careers of students” (p. 72). Similarly, this study found that Rose School District and Rose Middle School implemented practices and strategies that supported access for some students to advanced level classes: a challenging curriculum, intensive staff development, and quality mathematics instruction. When the school implemented strategies and practices that impacted all students, the initiatives had an effect on Black student enrollment in advanced classes as well. The findings of this study added to the body of literature that found a school’s efforts to provide its students with a challenging curriculum and to prepare staff to implement the challenging curriculum are key factors in school improvement reforms (Reeves, 2010).

This study contributes insights to Bryk et al.'s (2010) conceptual framework, which addressed the need for students to acquire skills “in the context of the extraordinary global changes that are taking place” (p. 53). They asserted that, while traditional skills in reading and mathematics are important, current demands in the job market require workers to “problem-solve and complete complex tasks that require analysis, synthesis, and knowledge application with accompanying communication and interpersonal skills while working in teams and diverse groups” (p. 53). Relationships were seen across categories. District and school leadership were seen as agents for change as indicated in the conceptual framework. They were the drivers for the wave of changes that took place with the mathematics course enrollment criteria: changes to course offerings, curriculum development, and teacher preparation. The changes in enrollment criteria caused an increased enrollment in advanced mathematics classes, including Black students. The teachers collaborated to revise the grade level curricula and related assessments. The revision in the curriculum spearheaded intensive staff development for effective mathematics instruction, which provided all students access to rigorous instruction with no variation for different levels of mathematics classes.

Similar to Bryk et al., (2010) findings, this study's findings suggest that Rose School District and Rose Middle School were strong in four of the five essential supports: strong school leadership, professional capacity of the faculty, instructional guidance, and a student centered learning climate. As indicated in the data, the school may need to continue to create additional avenues to build stronger communication with the parent community about enrollment criteria for advanced level mathematics classes. It is important to recognize that Rose Middle School, similar to other middle schools, is an organization that houses people who are interdependent with each other (Bryk et al, 2010). One component cannot be successful without the other. The students, especially the Black students, cannot develop the abilities they need without strong teachers who understand and implement a challenging curriculum and related activities. Students need teachers who care about them and want them to achieve. Since some students face a variety of barriers, they need strong leaders who expect all students to achieve at high levels by “focus[ing] on the right things: [effective] teaching, [challenging] curriculum, [rigorous] assessments” (Reeves, 2010, p. 65), and systems of support to access advanced levels of learning.

It must be noted that the procedures, practices, and strategies presented in this study that were implemented at Rose Middle School occurred over a course of four years. The point here is that it takes time to build professional capacity, student capacity, parent-community ties, and a belief system that everyone can achieve (Bryk et al, 2010). The school has made progress toward enrolling more Black students in advanced mathematics classes, yet continuing to offer a challenging curriculum and rigorous tasks will open up more opportunities for more students, especially Black students, since advanced mathematics classes have a domino effect on later student success in high school, college, and job opportunities.

## References

- Achieve (2008, May). *The building blocks of success: Higher-level math for all students*. Washington, DC: Author. Retrieved from <http://www.achieve.org/BuildingBlocksofSuccess>
- Adelman, C. (1999). *Answers in the toolbox: Academic intensity, attendance patterns, and Bachelor's degree completion*. Washington, DC: U.S. Department of Education. Retrieved from <http://files.eric.ed.gov/fulltext/ED431363.pdf>
- Adelman, C. (2006). *The toolbox revisited: Paths to degree completion from high school through college*. Washington, DC: U.S. Department of Education. Retrieved from [http://www.avid.org/dl/res\\_research/research\\_thetoolboxrevisited.pdf](http://www.avid.org/dl/res_research/research_thetoolboxrevisited.pdf)
- Adelman, C. (2007). Do we really have a college access problem? *Change: The Magazine of Higher Learning*, 39(4), 48-51. doi:10.3200/CHNG.39.4.48-51
- Allensworth, E., Nomi, T., Montgomery, N., & Lee, V. (2009). College preparatory curriculum for all: Academic consequences of requiring Algebra I and English 1 for ninth graders in Chicago. *Educational Evaluation and Policy Analysis*, 31(4), 367-391.
- Anderson, R., & Chang, B. (2011). Mathematics course-taking in rural high schools. *Journal of Research in Rural Education*, 26(1), 1-10.
- Andrews, R., & Soder, R. (1987). Principal leadership and student achievement. *Educational Leadership*, 44(6), 9-11.
- Anfara, V., Brown, K., Mangione, T. (2002). Qualitative analysis on stage: Making the research process more public. *Educational Researcher*, 31(7), 28-38.
- Aud, S., Hussar, W., Planty, M., Snyder, T., Bianco, K., Fox, M., Froehlich, L., Kemp, J., & Drake, L. (2010). *The condition of education 2010* (NCES 2010-028). Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.
- Azzam, A. M. (2008). Neglecting high achievers. *Educational Leadership*, 66(2), 90-92.
- Barkley, A. P. (2008, July). *The dynamics of learning: An economic model of student motivation and achievement*. Paper presented at the American Agricultural and Applied Economics Association Annual Meeting, Orlando, FL. Abstract retrieved from <http://ageconsearch.umn.edu/bitstream/6161/2/469101.pdf>

- Barth, R. (2007). Culture in question. In *The Jossey-Bass reader on educational leadership* (2<sup>nd</sup> ed.), (pp. 159-168). San Francisco, CA: John Wiley & Sons, Inc.
- Baum, S., Ma, J., & Payea, K. (2010). *Education pays 2010: The benefits of higher education for individuals and society*. Reston, VA: The College Board, Advocacy & Policy Center. Retrieved from: <http://trends.collegeboard.org/sites/default/files/education-pays-2013-full-report.pdf>
- Berends, M., Goldring, E., Stein, M., & Cravens, X. (2010). Instructional conditions in charter schools and students' mathematics achievement gains. *American Journal of Education*, 116(3), 303-335.
- Berry, III, R. Q. (2005). Voices of success: Descriptive portraits of two successful African American male middle school mathematics students. *Journal of African American Studies*, 8(4), 46-62.
- Billingsley, A. & Caldwell, C. H. (1991). The church, the family, and the school in the African American Community: Socialization forces affecting the education of African American youth in the 1990s. *The Journal of Negro Education*, 60(3), 427-440.
- Blankstein, A. M., & Noguera, P. A. (2010). Gaining active engagement from family and community. In A. M. Blankstein (Ed.), *Failure is not an option* (2<sup>nd</sup> ed., pp. 191-207). Thousand Oaks, CA: Corwin.
- Bloom, C. M., & Owens, E. W. (2013). Principals' perceptions of influence on factors affecting student achievement in low- and high-achieving urban high schools. *Education and Urban Society*, 45(2), 208-233.
- Bol, L., & Berry, R. Q. (2005, April). Secondary mathematics teachers' perceptions of the achievement gap. *The High School Journal*, 88(4), 32-45.
- Boykin, A. W., & Noguera, P. (2011). *Creating the opportunity to learn: Moving from research to practice to close the achievement gap*. Alexandria, VA: ASCD.
- Branch, G. F., Hanushek, E. A., & Rivkin, S. G. (2013). School leaders matter. *Education Next*, 13(1), 62-69.
- Brookover, W., & Lezotte, L. (1977). *Changes in school characteristics coincident with changes in student achievement*. East Lansing: Institute for Research on Teaching, College of Urban Development, Michigan State University. Retrieved from <http://education.msu.edu/irt/PDFs/OccasionalPapers/op017.pdf>

- Brosnan, P., Schmidlin, A., & Grant, M. (2013). Successful mathematics achievement is attainable. In J. Hattie & E. M. Anderman (Eds.), *International guide to student achievement* (pp. 348-350). New York: Routledge.
- Brown v. Board of Educ., 347 U.S. 483 (1954).
- Bryk, A., Sebring, P., Allensworth, E., Luppescu, S., & Easton, J. (2010). *Organizing school for improvement: Lessons from Chicago*. Chicago, IL: The University of Chicago Press.
- Burris, C. C., Heubert, J. P., & Levin, H. M. (2004, February). Math acceleration for all. *Educational Leadership*, 61(5), 68-71.
- Butin, D. W. (2010). *The education dissertation: A guide for practitioner scholars*. Thousand Oaks, CA: Corwin: A Sage Company.
- Cai, J., & Lester, F. (2010, April). *Why is teaching with problem solving important to student learning?* Reston, VA: National Council of Teachers of Mathematics. Retrieved from [http://www.nctm.org/uploadedFiles/Research\\_News\\_and\\_Advocacy/Research/Clips\\_and\\_Briefs/Research\\_brief\\_14\\_-\\_Problem\\_Solving.pdf](http://www.nctm.org/uploadedFiles/Research_News_and_Advocacy/Research/Clips_and_Briefs/Research_brief_14_-_Problem_Solving.pdf)
- Carbonaro, W. (2005). Tracking, students' effort, and academic achievement. *Sociology of Education*, 78(1), 27-49.
- Casteel, C. A. (2000). African American students' perceptions of their treatment by Caucasian teachers. *Journal of Instructional Psychology*, 27(3), 143-148.
- Chen, G., & Weikart, L. (2008). Student background, student climate, student disorder and student achievement: An empirical study of New York's middle schools. *Journal of School Violence*, 7(4), 3-32.
- Chen, X., & Carroll, C. D. (2005). *First-generation students in postsecondary education: Look at their college transcripts. Postsecondary education descriptive analysis report* (NCES 2005-171). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.
- Choy, S. (2001). *Students whose parents did not go to college: Postsecondary access, persistence, and attainment. Findings from the Condition of Education*. U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office. Retrieved from <http://www.eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED460660>

- Chubb, J. E., & Moe, T. M. (1990). *Politics, markets, America's schools*. Washington, DC: The Brookings Institution.
- Coleman, J. S., Campbell, E. Q., Hobson, C. J., McPartland, J., Mood, A. M., Weinfeld, F. D., et al. (1966). *Equality of educational opportunity*. U. S. Department of Education, National Center for Education Statistics. Washington, DC: Government Printing Office. Retrieved from <http://files.eric.ed.gov/fulltext/ED012275.pdf>
- College Board. (2012, February). *8<sup>th</sup> Annual AP Report to the Nation*. New York, NY: The College Board. Retrieved from <http://apreport.collegeboard.org/>
- Cooney, S., & Bottoms, G. (2002). *Middle grades to high school: Mending a weak link*. Atlanta, GA: Southern Regional Education Board.
- Cornelius-White, J. (2007, March). Learner-centered teacher-student relationships are effective: A meta-analysis. *Review of Educational Research*, 77(1), 113-143.
- Cotton, K. (1999). *Research you can use to improve results*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Cotton, K. (2000). *The schooling practices that matter most*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Cotton, K. (2003). *Principals and student achievement: What the research says*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Creswell, J. W. (2005). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (2<sup>nd</sup> Ed.). Upper Saddle River, NJ: Pearson Education.
- Crosnoe, R., Johnson, M. K., & Elder, G. H. (2004). Intergenerational bonding in school: The behavioral and contextual correlates of student-teacher relationships. *Sociology of Education*, 77(1), 60-81.
- Daggett, W. R. (2005). *Achieving academic excellence through rigor and relevance*. International Center for Leadership in Education: Rigor, Relevance, and Relationships for ALL Students. Retrieved from [http://www.leadered.com/pdf/academic\\_excellence.pdf](http://www.leadered.com/pdf/academic_excellence.pdf)
- Darensbourg, A., & Blake, J. (2014). Examining the academic achievement of Black adolescents: Importance of peer and parental influences. *The Journal of Black Psychology*, 40(2), 191-212.

- Darity, W., Castellino, D., Tyson, D., Cobb, C., & McMillen, B. (2001). *Increasing opportunity to learn via access to rigorous courses and programs: One strategy for closing the achievement gap for at-risk and ethnic minority students*. Raleigh, NC: North Carolina Department of Public Instruction. Retrieved from <http://dpi.state.nc.us/docs/academicservices/gifted/resources/reports/increasingopportunities.pdf>
- Darling-Hammond, L. (2004). The color line in American education: Race, resources, and student achievement. *Du Bois Review*, 1(2), 213-248.
- Darling-Hammond, L. (2005). Teaching as a profession: Lessons in teacher preparation and professional development. *The Phi Delta Kappan*, 87(3), 237-240.
- Darling-Hammond, L. (2007). Race, inequality and educational accountability: The irony of 'No Child Left Behind'. *Race Ethnicity and Education*, 10(3), 245-260.
- Darling-Hammond, L., Berry, B., & Thoreson, A. (2001). Does teacher certification matter? Evaluating the evidence. *Educational Evaluation and Policy Analysis*, 23(1), 57-77.
- Davis, H. A. (2013). Teacher-student relationships. In J. Hattie & E. M. Anderman (Eds.), *International guide to student achievement* (pp. 101-103). New York: Routledge.
- Dougherty, B. J. (2010, April). *Early Algebra through quantitative reasoning*. Presentation at the Research Pre-Session, National Council of Teachers of Mathematics Annual Meeting, San Diego, CA. (Symposium on early algebra).
- DuFour, R., DuFour, R., Eaker, R., & Many, T. (2006). *Learning by doing: A handbook for professional learning communities at work*. Bloomington, IN: Solution Tree.
- Earl, L., & Katz, S. (2002). Leading schools in a data rich world. In K. Leithwood, P. Hallinger, K. S. Louis, G. Furman-Brown, P. Gronn, B. Mulford, & K. Riley (Eds.), *Second international handbook of educational leadership and administration*. Dordrecht, NL: Kluwer.
- Edmonds, R. R. (1979, October). Effective schools for the urban poor. *Educational Leadership*, 37, 15-24.
- Ellington, R. M., & Frederick, R. (2010). Black high achieving undergraduate mathematics majors discuss success in persistence in mathematics. *Negro Educational Review*, 61(4), 61-84.

- Ellis, M. W., & Berry, III, R. Q. (2005). The paradigm shift in mathematics education: Explanations and implications of reforming conceptions of teaching and learning. *The Mathematics Educator*, 15(1), 7-17.
- Ferguson, R. F. (1998). Can schools narrow the Black-White test score gap? In C. Jenkins & M. Phillips (Eds.), *The Black-White test score gap* (pp. 318-374). Washington, DC: The Brookings Institute.
- Ferguson, R. F. (2007). Teachers' perceptions and expectations and the Black-White test gap. In J. Christopher & M. Phillips (Eds.), *Toward excellence with equity: An emerging vision for closing the achievement gap* (pp. 273-316). Cambridge, MA: Harvard Education Press.
- Ferguson, R. F., & Mehta, J. (2004). An unfinished journey: The legacy of Brown and the narrowing of the achievement gap. *The Phi Delta Kappan*, 85(9), 656-669.
- Flores, A. (2007, October). Examining disparities in mathematics education: Achievement gap or opportunity gap? *The High School Journal*, 91(1), 29-42.
- Ford, D., & Scott, M. (2010). Under-representation of African American Students in Gifted Education: Nine theories and frameworks for information, understanding, and change. *Gifted Education Press Quarterly*, 24(3), 1-6.
- Fordham, S., & Ogbu, J. (1986). Black students' school success: Coping with the "burden of acting White." *The Urban Review*, 18(3), 1-31. doi:10.1007/BF01112192
- Frome, P., & Dunham, C. (2002, April). *Influence of school practices on students' academic choices*. Research Triangle Park, NC: RTI, and Atlanta, GA: Southern Regional Education Board.
- Gall, M. D., Gall, J. P., & Borg, W. R. (2003). *Educational research: An introduction* (7<sup>th</sup> Ed.). Boston, MA: Allyn and Bacon.
- Gamoran, A., & Hannigan, E. (2000). Algebra for everyone? Benefits of college-preparatory mathematics for students with diverse abilities in early secondary school. *Educational Evaluation and Policy Analysis*, 22(3), 241-254.
- Geiser, S., & Santelices, V. (2004). The role of advanced placement and honors courses in college admissions. In P. Gandara, G. Orfield, & C. Horn (Eds.), *Expanding opportunities in higher education: Leveraging promise* (pp. 85-101). Albany, New York: State University of New York Press.

- Griffin, K., & Allen, W. (2006). Mo' money, mo' problems? High-achieving Black high school students' experiences with resources, racial climate, and resilience. *The Journal of Negro Education*, 75(3), 478-494.
- Grolnick, W. S., Raftery-Helmer, J. N., & Flamm, E. S. (2013). Parent involvement in learning. In J. Hattie & E. M. Anderman (Eds.), *International guide to student achievement* (pp. 101-103). New York: Routledge.
- Habegger, S. (2008, September). The principal's role in successful schools: Creating a positive school culture. *Principal*, 88(1), 42-46. Retrieved from [www.naesp.org](http://www.naesp.org)
- Hallinger, P., & Heck, R. H. (1996). Reassessing the principal's role in school effectiveness: A review of empirical research, 1980-1995. *Educational Administration Quarterly*, 32(1), 5-44.
- Hallinger, P., Bickman, L., & Davis, K. (1996). School context, principal leadership, and student achievement. *The Elementary School Journal*, 96(5), 527-549.
- Harper, S. R., Patton, L. D., & Wooden, O. S. (2009). Access and equity for African American students in higher education: A critical race historical analysis of policy efforts. *The Journal of Higher Education*, 80(4), 390-414.
- Hattie, J. (October, 2003). *Teachers make a difference: What is the research evidence?* Keynote presentation at the Building Teacher Quality: The ACER Annual Conference, Melbourne, Australia. Abstract retrieved from <http://www.educationalleaders.govt.nz/Pedagogy-and-assessment/Building-effective-learning-environments/Teachers-Make-a-Difference-What-is-the-Research-Evidence>
- Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. New York, NY: Routledge.
- Henry, S. (2000). What is school violence? An integrated definition. *The annals of the American academy of political and social science*, 567(1), 16-29.
- Herndon, M., & Hirt, J. (2004). Black students and their families: What leads to college success. *Journal of Black Studies*, 34(4), 489-513.
- Hidden curriculum (2014). In S. Abbott (Ed.), *The glossary of education reform*. Retrieved from <http://edglossary.org/multicultural-education/>

- Hodara, M., & Barton, R. (2014). Preparing secondary students for the challenges of secondary math. *Principal's Research Review*, 9(1), 1-6. Retrieved from National Association of Secondary Principal's website [http://www.nassp.org/Content/158/prr\\_jan14\\_web.pdf](http://www.nassp.org/Content/158/prr_jan14_web.pdf)
- Hofmeister, A., & Lubke, M. (1990). *Research into practice: Implementing effective teaching strategies*. Boston, MA: Allyn & Bacon.
- Holt, J. K., & Campbell, C. (2004, May). The influence of school policy and practice on mathematics achievement during transitional periods. *Education Policy Analysis Archives*, 12(23), 1-22.
- Hoover-Dempsey, D. V., & Sandler, H. M. (1997, Spring). Why do parents become involved in their children's education? *Review of Educational Research*, 67(1), 3-4.
- Hornby, G., & Lafaele, R. (2011). Barriers to parental involvement in education: An explanatory model. *Educational Review*, 63(1), 37-52.
- Ikemoto, G., & Marsh, J. (2007). *Cutting through the data-drive mantra: Different conceptions of data-driven decision making*. *Yearbook of the National Society for the Study of Education*, 105(1), 105-131.
- Jensen, E. (2009). *Teaching with poverty in mind: What being poor does to kids' brains and what schools can do about it*. Alexandria, VA: ASCD.
- Jesse, D., Davis, A., & Pokorny, N. (2004). High achieving middle schools for Latino students in poverty. *Journal of Education for Students Placed at Risk*, 9(10), 23-45.
- Jeynes, W. H. (2007). The relationship between parental involvement and urban secondary school student academic achievement. *Urban Education*, 42(1), 82-110.
- Kahlenberg, R. D. (2001, Summer). Learning from James Coleman. *The Public Interest*, 144, 54-73.
- Kelley, C., & Peterson, K. D. (2009). The work of principals and their preparation. *The Jossey-Bass reader on educational leadership* (pp. 351-401). San Francisco, CA: John Willey & Sons.
- Kirsch, I., Braun, H., Yamamoto, K., & Sum, A. (2007, January). America's perfect storm: Three forces changing our nation's future. *The Catalyst*, 36(1), 3-29. Retrieved from <http://files.eric.ed.gov/fulltext/ED496620.pdf>
- Kusiak, J. (2014, February). Virginia Performs: Measuring What Matter in Virginia. Retrieved from <http://vaperforms.virginia.gov/indicators/economy/poverty.php>

- Ladson-Billings, G. (1997). It doesn't add up: African American students' mathematics achievement. *Journal for Research in Mathematics Education*, 28(6), 697-708.
- Lee, J. (2004). Multiple facets of inequity in racial and ethnic achievement gaps. *Peabody Journal of Education*, 79(2), 51-73.
- Lee, J., & Bowen, N. K. (2006). Parental involvement, cultural capital and the achievement gap among elementary school students. *American Educational Research Journal*, 43(2), 193-218.
- Lee, V. E., & Smith, J. (2001). *Restructuring high schools for equity and excellence: What works*. New York: Teachers College Press.
- Leithwood, K., & Seashore-Louis, K. (2011). *Linking leadership to student learning*. San Francisco, CA: John Wiley & Sons.
- Leithwood, K., Louis, K. S., Anderson, S., & Wahlstrom, K. (2004). *Review of research: How leadership influences student learning*. St. Paul, MO: Learning from Research Project, University of Minnesota, Center for Applied Research and Educational Improvement.
- Levasseur, K., & Cuoco, A. (2003). Mathematical habits of mind. In H. L. Schoen & R. I. Charles (Eds.), *Teaching mathematics through problem-solving: Grades 6-12* (pp. 27-37). Reston, VA: National Council of Teachers of Mathematics.
- Levine, D., & Lezotte, L. (1990). *Unusually effective schools: A review of the analysis of research and practice*. Madison, WI: The National Center for Effective Schools Research & Development.
- Lezotte, L. (2002). *Revolutionary and evolutionary: The effective schools movement*. Okemos, MI: Effective School Products, Ltd.
- Lezotte, L., & Jacoby, B. (1990). *The school improvement process based on effective schools research: A guide*. Ann Arbor: Michigan Institute for Educational Management.
- Li, N., & Hasan, Z. (2010). Closing the achievement gap: Strategies for ensuring the success of minority students. *National Teacher Education Journal*, 3(2), 47-59.
- Loveless, T. (2008, September). *The misplaced math student: Lost in eighth-grade algebra*. The 2009 Brown Center Report on American Education. Washington, DC: The Brookings Institute.

- Marston, D. C. (2013, January). Neurobehavioral effects of poverty. *The SES indicator*. Washington DC: American Psychological Association. Retrieved from American Psychological Association website:  
<http://www.apa.org/pi/ses/resources/indicator/2013/01/poverty-behaviors.aspx>
- Martin-Lohfink, M., & Paulsen, M. B. (2005). Comparing the determinants of persistence for first-generation and continuing-generation students. *Journal of College Student Development, 46*(4), 409–428.
- Marzano, R. J. (2003). *What works in schools: Translating research into action*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Mastin, L. (2010). The glossary of mathematical terms. *The Story of Mathematics*. Retrieved from <http://www.storyofmathematics.com/glossary.html>
- Matsumura, L. C., Slater, S. C., & Crosson, A. (2008). Classroom climate, rigorous instruction and curriculum, and students' interactions in urban middle schools. *The Elementary School Journal, 108*(4), 293-312. doi:10.1086/528973
- Maurer, T. J., & Weiss, E. M. (2010). Continuous learning skill demands: Associations with managerial job content, age, and experience. *Journal of Business Psychology, 25*, 1-13.
- Maykut, P., & Morehouse, R. (1994). *Beginning qualitative research: A philosophic and practical guide*. Washington, DC: The Falmer Press.
- McCombs, B. (2000). Reducing the achievement gap. *Society, 37*(5), 29-36.
- McMillan, J. H., & Wergin, J. F. (2010). *Understanding and evaluating educational research* (4<sup>th</sup> ed.). Boston, MA: Pearson.
- McNeely, C. (2013). School connectedness. In J. Hattie & E. M. Anderman (Eds.), *International guide to student achievement* (pp. 149-151). New York: Routledge.
- Merriam, S. (1998). *Case study research in education: A qualitative approach*. San Francisco, CA: Jossey-Bass Publishers.
- Mirra, A. (2003). *Administrator's guide: How to support and improve mathematics education in your school*. Reston, VA: National Council of Teachers of Mathematics.
- Morrison-Gutman, L., & McLoyd, V. (2000). Parents' management of their children's education within the home, at school, and in the community: An examination of African-American families living in poverty. *The Urban Review, 32*(1), 1-24.

- Murphy, J. (1992). Effective schools: Legacy and future directions. In D. Reynolds & P. Cuttance (Eds.), *School effectiveness: Research, policy, & practice* (pp. 164-170). London: Cassell.
- National Center for Education Statistics. (2013). *The nation's report card: Trends in academic progress 2012* (NCES 2013-456). National Center for Education Statistics, Institute of Education Sciences. Washington, DC: U.S. Department of Education. Retrieved from <http://nces.ed.gov/nationsreportcard/pubs/main2012/2013456.aspx>
- National Council of Teachers of Mathematics. (2008, September). *Algebra: What, when, and for whom*. Retrieved from [http://www.nctm.org/uploadedFiles/About\\_NCTM/Position\\_Statements/Algebra%20final%2092908.pdf](http://www.nctm.org/uploadedFiles/About_NCTM/Position_Statements/Algebra%20final%2092908.pdf)
- National Education Association. (2003) Resolution B-16, 2005-2006 NEA Resolution, page 48.
- National Mathematics Advisory Panel. (2008). *Foundations for success: The final report of the National Mathematics Advisory Panel*. Washington, DC: U.S. Department of Education.
- National Research Council. (2010). *Adding it up: Helping children learn mathematics*. Washington, DC: The National Academies Press.
- Nettles, S. M., & Herrington, C. (2007). Revisiting the importance of the direct effects of school leadership on student achievement: The implications for school improvement policy. *Peabody Journal of Education*, 82(4), 724-736.
- Nickerson, G. T., & Kritsonis, W. A. (2006). An analysis of the factors that impact academic achievement among Asian American, African American, and Hispanic students. *National Journal of Publishing and Mentoring Doctoral Student Research*, 3(1), 1-4.
- No Child Left Behind (NCLB) Act of 2001, Pub. L. No. 107-110, § 115, Stat. 1425 (2002).
- Nomi, T. (2012). The unintended consequences of an algebra-for-all policy on high-skill students: Effects on instructional organization and students' academic outcomes. *Educational Evaluation and Policy Analysis*, 34(4), 489-505.
- Nunez, A. M., Bugarin, R., & Warburton, E. C. (2001). Bridging the gap: Academic preparation and postsecondary success of first-generation students. *Education Statistics Quarterly*, 3(3), 73-77.
- Ogbu, J. U. (2003). *Black American students in an affluent suburb: A study of academic disengagement*. Mahwah, NJ: Lawrence Erlbaum Associates.

- Orr, A. (2003, October). Black-White differences in achievement: The importance of wealth. *Sociology of Education*, 76(4), 281-304. doi:10.2307/1519867
- Patrick, H., Mantzicopoulos, P., Samarapungavan, A., & French, B. (2008). Patterns of young children's motivation for science and teacher-child relationships. *The Journal of Experimental Education*, 76(2), 121-144. doi:10.3200/JEXE.76.2.121-144
- Patton, M. Q. (2002). *Qualitative research & evaluation of methods* (3<sup>rd</sup> ed.). Thousand Oaks, CA: Sage Publications.
- Payne, R. (2003). *A framework for understanding poverty* (3<sup>rd</sup> ed.). Highlands, TX: Process.
- Pierce, C. (2001). Importance of classroom climate for at-risk learners. *Journal of Educational Research*, 88(1), 37-42. doi:10.1080/00220671.1994.9944832
- Planty, M., Hussar, W., Synder, T., Kena, G., KewalRamani, A., Kemp, J., Bianco, K., & Dinkes, R. (2009). *The condition of education 2009* (NCES 2009-81). Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.
- Protheroe, N. (2007). What does good math instruction look like? *Principal*, 7(1), 51-54.
- Purkey, S., & Smith, M. (1983). Effective school: A review. *The Elementary School Journal*, 83(4), 426-452.
- Reeves, D. (2003). *High performance in high poverty schools: 90/90/90 and beyond*. Denver, CO: Center for Performance Assessment.
- Reeves, D. (2010). *Transforming professional development into student results*. Alexandria, VA: ASCD.
- Resnicow, D., Wang, T., Dudley, W., Jackson, A., Ahluwalia, J., Baranowski, T., & Braithwaite, R. (2001). Risk factor distribution among demographically diverse African American adults. *Journal of Urban Health*, 78(1), 125-140.
- Riegle-Crumb, C., & Grodsky, E. (2010). Racial-ethnic differences at the intersection of math course-taking and achievement. *Sociology of Education*, 83(3), 248-270.
- Riegle-Crumb, C., & Humphries, M. (2012). Exploring bias in math teachers' perceptions of students' ability by gender and race/ethnicity. *Gender & Society*, 26(2), 290-322. doi:10.1177/0891243211434614
- Riley, R. W. (1997, October). *Mathematics and future opportunities: The importance of mathematics for college entrance*. Washington, DC: U.S. Department of Education.

- Retrieved from <http://www.learnodoearn.org/For-Educators/Math-and-Future-Opportunities.pdf>
- Robbins, R., Stagman, S., & Smith, S. (2012, October). *Young children at risk: National and state prevalence of risk factors*. New York, NY: National Center for Children in Poverty, Columbia University, Mailman School of Public Health. Retrieved from [http://www.nccp.org/publications/pdf/text\\_1073.pdf](http://www.nccp.org/publications/pdf/text_1073.pdf)
- Robers, S., Kemp, J., Truman, J., & Snyder, T. (2013). *Indicators of school crime and safety: 2012* (NCES 2013-036/NCJ 241446). Washington, DC: National Center for Education Statistics, U.S. Department of Education, and Bureau of Justice Statistics, Office of Justice Programs, U.S. Department of Justice. Retrieved from <http://nces.ed.gov/pubs2013/2013036.pdf>
- Roberts, C. M. (2010). *The dissertation journey: A practical and comprehensive guide to planning, writing, and defending your dissertation* (3<sup>rd</sup> ed.). Thousand Oaks, CA: Sage Publications.
- Rossmann, G. B., & Rallis, S. F. (2012). *Learning in the field: An introduction to qualitative research*. Thousand Oaks, CA: Sage.
- Schmoker, M. (2006). Measuring what matters. *Educational Leadership*, 66(4), 70-74.
- Schott Foundation. (2009). *National opportunity to learn campaign: Federal recommendations*. Cambridge, MA: Schott Foundation for Public Education. Retrieved from [http://ea.niusileadscape.org/docs/FINAL\\_PRODUCTS/LearningCarousel/otl-federal-recommendations-final.pdf](http://ea.niusileadscape.org/docs/FINAL_PRODUCTS/LearningCarousel/otl-federal-recommendations-final.pdf)
- Seeley, C. (2005, October). Untapped potential. *NCTM News Bulletin*. Retrieved from [http://www.nctm.org/uploadedFiles/About\\_NCTM/President/Past\\_Presidents\\_Messages/Seeley\\_Messages/2005\\_07\\_untapped.pdf](http://www.nctm.org/uploadedFiles/About_NCTM/President/Past_Presidents_Messages/Seeley_Messages/2005_07_untapped.pdf)
- Seidman, R. (2006). *Interviewing as qualitative research: A guide for researchers in education and the social sciences*. New York, NY: Teacher College Press.
- Sergiovanni, T. (2001). *Leadership: What's in it for schools?* London, Routledge Falmer.
- Sessa, V. I. & London, M. (2006). *Continuous learning in organizations: Individual, group, and organizational perspectives*. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Simon, M. K. (2011). *Dissertation and scholarly research: Recipes for success*. Seattle, WA: Dissertation Success, LLC.

- Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research, 75*(3), 417-453.  
doi:10.3102/00346543075003417
- Smith, M. J. (2008). College choice process of first generation minority female students: Encouraged to what end? *Negro Educational Review, 59*, 147-161.
- Soehner, D., & Ryan, T. (2011). The interdependence of principal school leadership and student achievement. *Scholar-Practitioner Quarterly, 5*(3), 275-288.
- Sowell, T. (2001). *The education of minority children*. Stanford, CT: The Hoover Institution.  
Retrieved from [http://media.hoover.org/sites/default/files/documents/0817928928\\_79.pdf](http://media.hoover.org/sites/default/files/documents/0817928928_79.pdf)
- Spielhagen, F. R. (2006). Closing the achievement gap in math: Considering eighth grade Algebra for all students. *American Secondary Education, 34*(3), 29-42.
- Spielhagen, F. R. (2010). Algebra for everyone? Student perceptions of tracking in mathematics. *Middle Grades Research Journal, 5*(4), 214-223.
- Spielhagen, F. R. (2011). *The algebra solution in mathematics reform: Completing the equation*. NY: Teachers College Press.
- Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identities and performance. *American Psychologist, 52*(6), 613-629.
- St. John, E. P., & Chung, A. S. (2006). Access to advanced math. In E. P. St. John (Ed.), *Education and the public interest: School reform, public finance, and access to higher education* (pp. 135-162). Dordrecht, Netherlands: Springer.
- Star, J. R. (2002). Re-conceptualizing procedural knowledge: The emergence of “intelligent” performances among equation solvers. In D. Mewborn, P. Sztajn, D. White, H. Weigel, R. Bryant, & K. Nooney (Eds.), *Proceedings of the 28th Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 999-1007). Columbus, OH: ERIC Clearinghouse for Science, Mathematics, and Environmental Education.
- Stewart, E. B. (2008). School structural characteristics, student effort, peer associations, and parental involvement: The influence of school- and individual-level factors on academic achievement. *Education and Urban Society, 40*(2), 179-204.  
doi:10.1177/0013124507304167

- Stringfield, S., & Herman, R. (1996). Assessment of the State of School Effectiveness Research in the United States of America. *School effectiveness and school improvement: An international journal of research, policy and practice*, 7(2), 159-180.  
doi: 10.1080/0924345960070204
- Stronge, J. H. (2007). *Qualities of effective teachers* (2<sup>nd</sup> ed.). Alexandria, VA: Association of Supervision and Curriculum and Development.
- Stronge, J. H., Richard, H. B., & Catano, N. (2008). The ultimate challenge: The principal's role in student achievement. In J. H. Stronge, H. B. Richard, & N. Catano (Eds.), *Qualities of effective principals* (pp. 138-145). Alexandria, VA: Association for Supervision and Curriculum Development.
- Tate, W. F. (2005). *Access and opportunities to learn are not accidents: Engineering mathematical progress in your school*. Greensboro, NC: The Southeast Eisenhower Regional Consortium for Mathematics and Science Education (SERVE). Retrieved from <http://www.serve.org/uploads/publications/AccessAndOpportunities.pdf>
- Taylor, A. Z., & Graham, S. (2007). An examination of the relationships between achievement values and perceptions of barriers among low-SES African American and Latino students. *Journal of Educational Psychology*, 99, 52-64. doi:10.1037/0022-0663.99.1.52
- Trimble, S. (2002, March). Common elements of high performing, high poverty middle schools. *Middle School Journal*, 33(4), 7-16.
- U.S. Department of Commerce. (2001a). *The Black population in the United States*. Washington, D.C.: Bureau of the Census.
- U.S. Department of Education. (2004). *Executive summary of the No Child Left Behind Act of 2001*. Washington, DC: Author. Retrieved from [http://www.nlts2.org/reports/2005\\_03/nlts2\\_report\\_2005\\_03\\_execsum.pdf](http://www.nlts2.org/reports/2005_03/nlts2_report_2005_03_execsum.pdf)
- Virginia Department of Education. (2010). *Virginia college and career readiness initiative*. Richmond, VA: Instruction. Retrieved from [http://www.doe.virginia.gov/instruction/college\\_career\\_readiness/resources/introductory\\_briefing.pdf](http://www.doe.virginia.gov/instruction/college_career_readiness/resources/introductory_briefing.pdf)
- Virginia Department of Education. (2011). *SOL Test Scoring & Performance Reports*. Richmond, VA: Standards of Learning (SOL) & Testing. Retrieved from <http://www.doe.virginia.gov/testing/scoring/>

- Virginia Department of Education. (2013). *Data for research*. Richmond, VA: Statistics and Reports. Retrieved from [http://www.doe.virginia.gov/statistics\\_reports/enrollment/index.shtml](http://www.doe.virginia.gov/statistics_reports/enrollment/index.shtml)
- Virginia Department of Education. (2013). *Requirements and implementation of a Title I school-wide program*. Richmond, VA: Office of Program and Administration Accountability. Retrieved from [http://www.doe.virginia.gov/federal\\_programs/esea/professional\\_dev/program\\_admin\\_annual\\_2011/requirements\\_implementation\\_of\\_title1\\_schoolwide\\_program.pdf](http://www.doe.virginia.gov/federal_programs/esea/professional_dev/program_admin_annual_2011/requirements_implementation_of_title1_schoolwide_program.pdf)
- Virginia Department of Education. (2013). *School report card*. Richmond, VA: Statistics and Reports. Retrieved from [http://www.doe.virginia.gov/statistics\\_reports/school\\_report\\_card/index.shtml](http://www.doe.virginia.gov/statistics_reports/school_report_card/index.shtml)
- Virginia Department of Education. (2013). *What parents & students should know about the new Virginia mathematics standards of learning*. Richmond, VA: Standards of Learning and Testing. Retrieved from [http://www.doe.virginia.gov/testing/sol/standards\\_docs/mathematics/parents\\_students\\_should\\_know.shtml](http://www.doe.virginia.gov/testing/sol/standards_docs/mathematics/parents_students_should_know.shtml)
- Virginia Department of Education. (2014). *Glossary*. Richmond, VA: Standards of Learning (SOL) & Testing. Retrieved from <http://www.doe.virginia.gov/testing/glossary.shtml>
- Walker, E. N. (2006). Challenging limiting assumptions: High-quality mathematics for underserved students. *Understanding Educational Equity and Excellence at Scale*. Retrieved from <http://www.tc.columbia.edu/faculty/walker/scale.pdf>
- Walker, E. N. (2007). Why aren't more minorities taking advanced math? *Educational Leadership*, 65(3), 48-53.
- Wang, J., & Goldschmidt, P. (2003). Importance of middle school mathematics on high school students' mathematics achievement. *The Journal of Educational Research*, 97(1), 3-17. doi:10.1080/00220670309596624
- Warner, C. H. (2010). Emotional safeguarding: Exploring the nature of middle class parents' school involvement. *Sociological Forum*, 25(4), 703-724. doi:10.1111/j.1573-7861.2010.01208.x

- Waters, T., Marzano, R., & McNulty, B. (2003). *Balanced leadership: What 30 years of research tells us about the effects of leadership on student achievement*. Aurora, CO: Mid-Continent Research for Education and Learning.
- Weiher, G., & Tedin, K. (2006). Minority student achievement. *Review of Policy Research*, 23(5), 963-967. doi:10.1111/j.1541-1338.2006.00244.x
- Whitehouse, S. (2009). Six strategies to help young adolescents at the tipping point in urban middle schools. *Middle School Journal*, 40(5), 18-21.
- Wiersma, W. (2000). *Research methods in education: An introduction*. Boston, MA: Allyn and Bacon.
- William, D., & Bartholomew, H. (2004). It's not which school but which set you're in that matters: The influence of ability grouping practices on student progress in mathematics. *British Educational Research*, 30(2), 279-295.
- Williams, A. (2011, February). A call for change: Narrowing the achievement gap between White and Minority students. *The Clearing House*, 84, 65-71.
- Williams, T., Haertel, E., Kirst, M. W., Rosin, M., & Perry, M. (2011). *Preparation, placement, proficiency: Improving middle school grades math performance*. Mountain View, CA: EdSource.
- Yin, R. K. (2009). *Case study research: Design and methods* (4<sup>th</sup> Ed.). Washington, DC: Sage.
- Zuckerman, M. B. (2011, September). Why math and science education means more jobs: Americans must become more competitive in the science, technology, engineering, and math fields. *U. S. News and World Report*. Retrieved from [www.usnews.com/opinion/articles/2011/09/27/why-math-and-science-education-means-more-jobs](http://www.usnews.com/opinion/articles/2011/09/27/why-math-and-science-education-means-more-jobs)

## Appendix A

### Initial Phone Contact to Superintendent, Principal, or Assistant Principal Requesting Permission to Conduct the Study

Hello, my name is Bernice Cobbs, and I am a doctoral candidate in the Educational Leadership and Policy Studies program at Virginia Polytechnic Institute and State University, working under the direction of Dr. William J. Glenn.

The topic of my dissertation study focuses on examining and explaining, using a case study design, how \_\_\_\_\_ Middle School developed and implemented practices and policies to prepare and support Black student achievement in honors and advanced mathematics classes. I would like to invite \_\_\_\_ Middle School to participate in this research study. Information collected in this study may be useful to school divisions with regard to improving Black student enrollment and achievement in such classes. The study will involve interviews with, but not limited to, central office personnel, principal, administrators, teachers, mathematics specialist(s), and guidance counselors. I would also like to conduct observations and review school-related documents.

Would you be willing to grant permission for me to conduct this research in \_\_\_\_ Middle School?

\*If superintendent agrees to the study, proceed with the following: Thank you for your time and consideration. I will email a brief explanation of the study today. Should you have any questions or require further information, please do not hesitate to contact me via the telephone number or email address listed in the email you will receive. Again, thank you for this opportunity.

(Principal or assistant principal only - \_\_\_\_\_, Superintendent, has given me permission to contact you.) I am requesting permission to conduct my study within your middle school. The study will involve interviews, observations, and document analysis.

Would you be willing to grant permission for me to conduct my research in your school?

\*If the superintendent or principal declines to provide permission to conduct the study proceed with the following script: Thank you for speaking with me today and giving consideration to my study. I appreciate your time.

Very truly yours,

Bernice Cobbs, Researcher  
Virginia Tech Doctoral Candidate  
[bernice.cobbs@frco.k12.va.us](mailto:bernice.cobbs@frco.k12.va.us)

## Appendix B

### Dissertation Proposal Information

J. Bernice Cobbs

230 Orchard Ave, Rocky Mount, VA 24151

School Phone (540) 483-5105 Cell (540) 493-6425 Email:bernice.cobbs@frco.k12.va.us

**Dissertation Study Title:** Preparing and Supporting Black Students to Enroll and Achieve in Advanced Mathematics Classes in Middle School: A Case Study

The brief overview of the dissertation proposal study will include the following: (1) background and introduction of the topic, (2) why the district and specific school was chosen, (3) what is the timeframe of the study, (4) who are the desired participants, (5) what, if any, potential for disruptions to the learning environment exists, (6) and what is the benefit for the school participating in the study. If the Superintendent gives permission to conduct the study, the following will occur.

**Background and Introduction of the topic:** The minority achievement gap is a major concern among educators and policymakers. Studies evidence that those students who participate in a rigorous mathematics curriculum experience more gains than students who do not. One way to increase minority student achievement is to prepare students for and support minority student enrollment in advanced and honors mathematics classes at the middle school level. Using this middle school as my research site, I desire to examine and describe, using a case study design, how this middle school developed and implemented practices and policies to prepare and support Black student achievement in advanced mathematics classes. The middle school focus is significant because the underrepresentation of minorities in such classes limits later progression through rigorous mathematics courses at the high school, college, and even job competitiveness.

**Purpose of the study:** Therefore, the purpose of this qualitative study is to (1) identify practices, strategies, policies, and procedures used to prepare and sustain student enrollment in such classes; (2) identify and interview the individuals who engage in the day-to-day work of influencing student enrollment and determine how they influenced student enrollment in advanced mathematics courses; and (3) conduct observations, review documents, and examine how the participating school prepares students mathematically for the rigorous coursework associated with honors and advanced mathematics classes. The results will be presented in a discussion of themes and patterns. This research will be used as part of my doctoral degree program.

**Why this specific division and school were chosen:** The reason for selecting \_\_\_\_\_ Middle School is that I have reviewed school data from other middle schools in Virginia that offer mathematics courses. Unlike many of the schools reviewed, your particular middle school offers eighth graders the opportunity to take Algebra I in the eighth grade.

**What is the timeframe of the study:** I would like to conduct the interviews with the identified staff at the school site, conduct observations at the participating school site, and review related school documents. Completion of all 40-50 minute interviews, 20-30 minutes observations, and document reviews should take approximately two weeks.

**Who are the desired participants:** The desired participants are Principal, Assistant Principal, Instructional Coach, if available, Mathematics Department Chair or Teacher Leader, Central Office representatives, Mathematics Teachers, Guidance Counselors (Academic Advisors), and any other related school personnel in your school who have been identified as potential case study participants. Staff participation will be completely voluntary and confidential. No identifying information will be mentioned in the study. Participants will be fully apprised of the study and the risks and benefits of participation. Upon completion of the study, any identifying information in data collected will be destroyed after the successful defense of the dissertation.

**What, if any, disruptions to the learning environment:** I will respect the learning environment and research site at all times. I will not disrupt the learning environment nor will I attempt to make any changes or suggestions. My presence, at first, may affect the environment until familiarity is built with individuals at the school. I will refrain from (1) evaluative practices and (2) introducing issues that may cause participants to question the organization. I will remain a nonparticipant observer (1) who visits the school, (2) who records and collects data related to the topic of study, and (3) who will not become involved in the day-to-day life of the school.

**What is the benefit for the school participating:** While no promises or guarantees of benefits have been made to encourage you to participate in this study, my hope is that there will be larger educational benefits from this research. Although mathematics preparation is crucial for life-long aspirations and for self-sufficiency in the world, researchers indicate that minorities are underrepresented in honors and advanced classes. By completing the case study, I hope to identify and share with other educators, policymakers, students, and families, the specific policies, procedures, interventions, and strategies used to encourage student achievement in advanced mathematics classes. By sharing the pertinent information, my hope is that other schools can use the results of the study to positively influence mathematics preparation, which is a local, state, and national concern.

Respectfully submitted,

Mrs. Bernice Cobbs, Researcher  
Virginia Tech Doctoral Candidate  
(540) 493-6425  
bernice.cobbs@frco.k12.va.us

## Appendix C

### Thank You Letter to Superintendent Who Agrees to Allow Access to the Division

Date

John Doe, Superintendent  
Anywhere County Public Schools  
1234 Maple Street  
Anytown, VA 24000

Dear Superintendent Doe,

Thank you for allowing me to conduct part of my dissertation research in \_\_\_\_\_  
Public Schools. I will contact \_\_\_\_\_ Middle School's principal for introductory purposes and to  
establish a protocol for obtaining the necessary list of staff, as per our telephone discussion on  
\_\_\_\_\_. Again, please accept my sincere appreciation for your willingness to support this  
research through Virginia Tech.

Most sincerely,

Bernice Cobbs, Researcher  
Virginia Teach Doctoral Candidate  
Email: bernice.cobbs@frco.k12.va.us  
Cell phone: (540) 493-6425

## **Appendix D**

### **Virginia Tech Informed Consent for Participants in Research Projects**

#### **Involving Human Subjects**

Title of Project: Preparing and Supporting Black Students to Enroll and Achieve in Advanced Mathematics Classes in Middle School: A Case Study

Investigator(s): Bernice Cobbs, Virginia Tech Doctoral Student

#### **I. Purpose of this Research/Project**

The minority achievement gap is a major concern among educators and policymakers. Studies evidence that those students who participate in a rigorous mathematics curriculum experience more gains than students who do not. One way to increase minority student achievement is to prepare and support minority student enrollment in advanced and honors mathematics classes at the middle and high school level. The purpose of this study is to examine and describe, using a case study design, how one designated middle school developed and implemented practices and policies to prepare and support student achievement in such classes. The middle school focus is significant because the underrepresentation of minorities in such classes limits later student access to rigorous coursework at the high school and college levels, and even job competitiveness. The purpose of this study is also to identify and interview the individuals who engage in the day-to-day work of influencing student enrollment and determine how they influenced student achievement in advanced mathematics courses.

I will conduct semi-structured interviews with school administrators, central office personnel, teachers, guidance counselors, and other related school personnel in your school or division, which has been identified as the case study site. I will also complete observations and review related school documents. The results will be presented in a discussion of themes and patterns. This research will be used as part of my doctoral degree program.

#### **II. Procedures**

I reviewed school data from other middle schools in Virginia that offer honors and advanced mathematics courses. Unlike many of the schools reviewed, your particular middle school offers students the opportunity to take Algebra I in the eighth grade. I am very interested in the practices, policies, procedures, and strategies used in the school to encourage Black student achievement in advanced mathematics classes.

I would like to conduct the interviews with the identified staff at the school site. All interviews should take approximately 40-50 minutes to complete over a timeframe of about two weeks.

I would also like to observe relevant events, activities, classrooms that relate to student mathematics achievement, course selection, and registration for the upcoming school year. I am also requesting to review and collect, from the administrative team, specific school-related documents relating to the mathematics program at this school. These documents may include, if

available, (a) Grades 6-8 school course guide or Grades 6-8 programs of study, (b) Grades 6-8 mathematics class offerings, (c) Grades 6-8 levels of mathematics class offerings, (d) Grades 6-8 student handbook, (e) parent notification system about course offerings, (f) parent notification systems about registration, (g) guidance counselors notifications systems or course brochures related to academic advising, (h) math department collaborative meeting minutes, (i) division and school regulations and policies relating to mathematics programs/classes, (j) school's improvement plan, (k) Grades 6-8 school mathematics curriculum and pacing guides, (l) sample of principal's or assistant principal's weekly newsletter, messages, faculty agenda or other communication to students, staff, families, and extended community, (m) data collection forms for assessments, (n) academic assistance procedures for struggling learners, (o) school demographics and statistical information, (p) master schedules for teachers and school staff, (q) professional development opportunities for current school year, and (r) procedures for mathematics placement.

I am contacting the Principal via telephone and then you and the other participants through a letter in the mail to invite all identified subjects to participate in the study. I will also make telephone contacts with you and the other identified subjects to confirm participation, set specific meeting dates and times, and secure additional professional and program information. Permission for all study participants, including you, will be obtained prior to the beginning of the interview or the case study.

During the interview, I will use one digital recorder to record all interviews and to ensure that all information is retrieved for transcribing and analyzing. A questionnaire guide will be used during the interview. I will also take notes, keep a journal, and record relevant information following each interview so as to allow for reflections, observations, and descriptive notes. An observational protocol will also be used to record notes during the designated observations of meetings, classroom visits, and other informational visits.

### **III. Risks**

There are minimal risks associated with this study. I will assure you and all other individuals in this study of their confidentiality. I also assure you that you have the opportunity and right to change your mind and withdraw from the research process at any time during the process. If you must seek medical or counseling services as a result of your participation in this research, neither Virginia Tech nor I have funds to pay for such services, and the costs of such services must be paid by you.

### **IV. Benefits**

While no promises or guarantee of benefits have been made to encourage you to participate in this study, I hope that there will be larger educational benefits from this research. By completing the case study, my hope is to identify and share with other educators, scholars, students, and families, the specific policies, procedures, interventions, and strategies used to enroll and support student achievement in advanced mathematics classes. I also hope to identify the specific individuals who influence student achievement and determine how and why they influenced the participation and achievement in these classes. By sharing the pertinent information, my hope is

that other schools can use the results of the study to influence how schools prepare students and support their enrollment in advanced mathematics classes.

**V. Extent of Anonymity and Confidentiality**

Every effort will be made to hide your identity in any written work resulting from this study. Fake names will be used to identify you in any written materials. I will try to minimize the possibility of identifying other people you may mention. Fake names will be used in any printed materials. Furthermore, no mention of the actual name of the school or individuals will be made. Within the transcripts, you will be identified by a number. Digital recordings of the interview will be transcribed and stored in a locked file box at my home. I am the only individual who will have access to the recordings and transcriptions. Copies of the transcripts may be viewed by other members of my graduate committee or me. It is possible that the Institutional Review Board (IRB) may view my collected data for auditing purposes. The IRB is responsible for the oversight of the protection of human subjects involved in research. All data will be destroyed after the dissertation defense, publication of any articles resulting from the study, or presentations made related to the study.

**VI. Compensation**

There will be no money given to you for participating in this study.

**VII. Freedom to Withdraw**

You are free to stop participating in this study at any time. You may feel free to not answer any questions. If there are circumstances which arise and it is determined that you should not continue as a subject, the interview will end.

**VIII. Subject's Responsibilities**

I voluntarily agree to participate in this study. I have the following responsibilities:

- I agree to answer questions honestly. Initial \_\_\_\_\_
- I agree to allow the researcher to record the interview on tape. Initial \_\_\_\_\_
- I agree to allow the researcher to use a non-identifying direct quote. Initial \_\_\_\_\_

**IX. Subject's Permission**

I have read the Consent Form and conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent:

\_\_\_\_\_ Date \_\_\_\_\_  
Subject signature

Joyce Bernice Cobbs  
Investigator

540-493-6425/bcjoyce4@vt.edu  
Telephone/e-mail

Dr. William J. Glenn  
Faculty Advisor

703-538-8493/wglenn@vt.edu  
Telephone/e-mail

Should I have any pertinent questions about this research or its conduct, and research subjects' rights, and whom to contact in the event of a research-related injury to the subject, I may contact:

David M. Moore  
Chair, Virginia Tech Institutional Review  
Board for the Protection of Human Subjects  
Office of Research Compliance  
2000 Kraft Drive, Suite 2000  
Blacksburg, VA 24060

540-231-4991/moored@vt.edu  
Telephone/e-mail

**[NOTE: Subjects must be given a complete copy (or duplicate original) of the signed Informed Consent.]**



## Appendix F

### Criteria for Selecting Possible Study Participants

Principal or Designee Name: \_\_\_\_\_

Date: \_\_\_\_\_

Please use the criteria below for selecting possible study participants. Please list names and accompanying information on attached form (see Appendix E). Once completed, you may return via my email address ([bernice.cobbs@frco.k12.va.us](mailto:bernice.cobbs@frco.k12.va.us)).

Selection criteria for potential participants.

- **Principal.** The following criteria are required for principals to be considered as a potential participant in the study.
  1. Has at least one year of experience in current position.
  2. Creates or supports professional development opportunities.
  3. Must currently supervise at least one teacher who teaches honors, high level or advanced mathematics class.
- **Assistant Principal.** The following criteria are required for assistant principals to be considered as potential participants in the study.
  1. Has at least one year of experience in their current position.
  2. Creates or supports professional development opportunities.
  3. Must currently supervise at least one teacher who teaches honors, high level or advanced mathematics classes.
- **Mathematics Teachers.** The following criteria are required for teachers to be considered as potential participants in the study.
  1. Has at least one year of experience in their current position.
  2. Teaches Grades 6-8 mathematics or related subject areas.
  3. Holds a valid teaching license.
- **Teacher Leaders.** The following criteria are required for teacher leaders to be considered as potential participants in the study. Many teachers serve as leaders among their peers. This individual may or may not hold a title but is seen throughout the school as a leader and facilitator of teaching and learning.

1. Has at least one year experience in the current position.
  2. Facilitates or supports curriculum development, mentoring, instructional practices, data collection and analysis, or professional development.
  3. Holds a valid teaching license.
- Guidance Counselor. The following criteria are required for guidance counselors to be considered as potential participants in the study.
    1. Has at least one year experience in the current position.
    2. Holds a valid counseling and/or teaching license.
    3. Helps students and parents determine courses of study and possible college or vocational choices.
    4. Is a liaison between the elementary and high school in supporting transitions.
    5. Provides academic counseling.
  - Other staff members or individuals who engage in the day-to-day work of influencing student enrollment in advanced mathematics courses. No criteria set. These individuals are recommended by the superintendent, principal, assistant principal or teachers.

## Appendix G

### Phone Call Script for Teacher Participants in Qualitative Study

Hello, my name is Bernice Cobbs, and I am a doctoral candidate in the Educational Leadership and Policy Studies program at Virginia Polytechnic Institute and State University, working under the direction of Dr. William J. Glenn. The topic of my dissertation study focuses on examining and describing student preparation and achievement in honors and advanced mathematics classes, and I am seeking individuals who would be willing to participate in this research.

I have contacted Dr. \_\_\_\_ (superintendent), who has given me permission to conduct this research with administrators, teachers, guidance counselors, and related staff who are currently employed with \_\_\_\_\_ Middle School. I have also contacted your principal, \_\_\_\_ who is aware of this research.

Your name has been submitted to me by \_\_\_\_, principal, because you have at least one year of teaching experience at the middle school level, and you teach varied levels of mathematics. Your participation in this study would involve a 40-50 minute interview at a time and place convenient to you. Schools and participants will not be identified in the report of the study. All information provided will be held in strict confidence.

Your participation will be greatly appreciated. Would you be willing to be a participant in this study? (If individual declines, proceed with the following.) Thank you so much for your time and consideration of this study.

(If individual agrees, proceed with the following.) Would you be willing to set a date and time for the interview today? I will email you a brief explanation of the study today along with a confirmation of the date and time of the interview. Should you have any questions or require further information, please do not hesitate to contact me via the telephone number or email address listed in the email. I look forward to meeting with you on \_\_\_\_\_. Thank you. I very much appreciate your willingness to participate in this study.

## Appendix H

### Phone Call Script for Guidance Counselor Participants in Qualitative Study

Hello, my name is Bernice Cobbs, and I am a doctoral candidate in the Educational Leadership and Policy Studies program at Virginia Polytechnic Institute and State University, working under the direction of Dr. William J. Glenn. The topic of my dissertation study focuses on examining and describing student preparation and achievement in honors and advanced mathematics classes, and I am seeking individuals who would be willing to participate in this research.

I have contacted Dr. \_\_\_\_\_ (superintendent), who has given me permission to conduct this research with administrators, teachers, and guidance counselors who are currently employed with \_\_\_\_\_ County. I have also contacted your principal, \_\_\_\_\_, who is aware of this research.

Your name has been submitted to me by \_\_\_\_\_, principal, because you have at least one year of experience as a guidance counselor at the middle school level. You also have experience with academic counseling, helping students transition from elementary and on to the high school, and you have experience with your school's course guides and class offerings. Your participation in this study would involve a 40-50 minute interview at a time and place convenient to you. Schools and participants will not be identified in the report of the study. All information provided will be held in strict confidence.

Your participation will be greatly appreciated. Would you be willing to be a participant in this study? (If individual declines, proceed with the following.) Thank you so much for your time and consideration of this study.

(If individual agrees, proceed with the following.) Would you be willing to set a date and time for the interview today? I will email you a brief explanation of the study today along with a confirmation of the date and time of the interview. Should you have any questions or require further information, please do not hesitate to contact me via the telephone number or email address listed in the email. I look forward to meeting with you on \_\_\_\_\_. Thank you. I very much appreciate your willingness to participate in this study.

## **Appendix I**

### **Thank You and Confirmation Email to Study Participants**

Date

Dear

Thank you so much for agreeing to participate in this study. This email is to confirm our interview on \_\_\_\_\_ at \_\_\_\_\_ (a.m. or p.m.) at \_\_\_\_\_ (location). I look forward to meeting with you at that time. Attached to this email is a brief explanation of the study. If you have any questions or would like to speak with me prior to our interview, please feel free to contact me at the phone number or email address listed below.

Very truly yours,

Bernice Cobbs, Researcher

Virginia Tech Doctoral Candidate

Email: [bernice.cobbs@frco.k12.va.us](mailto:bernice.cobbs@frco.k12.va.us)

Cell phone: (540) 493-6425

**Appendix J**  
**Observation Protocol**

(Constant Comparative Analysis)

**Topic:** Preparing and Supporting Black Students to Enroll and Achieve in Advanced Mathematics Classes in Middle School: A Case Study

**Date and Time:**

**Setting:**

**Description of observation:**

**How does this observation relate to topic:**

**Are there any actions or interactions that relate to the topic:**

**Reflective notes and observations:**

**Each meeting will be digitally recorded and descriptive and reflective notes taken.**

(**Key Ideas:** Actions and interactions could pertain to schedules, class work, homework, instruction, student achievement, access, opportunities, practices, policies, attitudes, concerns, beliefs, relationships, leadership, and support.)

## **Appendix K**

### **Meeting/Interview Protocol: Principal, Assistant Principal, Instructional Coach, Teachers, Guidance Counselors, and Director of Instruction**

**Title of Study:** Preparing and Supporting Black Students to Enroll and Achieve in Advanced Mathematics Classes in Middle School: A Case Study

**Date and Time of Meeting/Interview:**

**Place:**

**Names of Participant(s)/Interviewee(s):**

**Agenda Items Presented:**

**Agenda Items Covered and Discussed:**

**Responses of Meeting Participants:**

**Reflective Notes and Observations:**

## Appendix L

### **Interview Protocol Script for Principal, Assistant Principal, Teacher, Department Chair, and Guidance Counselors Study Participants**

**Topic:** Preparing and Supporting Black Students to Enroll and Achieve in Advanced Mathematics Classes in Middle School: A Case Study

Thank you for agreeing to be a participant in this study. I would like to explain the purpose of this study before we begin. The purpose of this study is to examine and describe, using a case study design, how one designated middle school developed and implemented practices and policies to prepare and support Black student achievement in honors and advanced mathematics classes. The middle school focus is significant because the underrepresentation of minorities in such classes limits later progression through rigorous mathematics courses at the high school and college level, and even job competitiveness.

Your participation will require no more than 40-50 minutes, and all communication regarding the content validation may be completed via email for your convenience. I will gather information from principals, assistant principals, teachers, guidance counselors, and central office personnel from one school division in Virginia in the form of interviews and then analyze the interview responses for common themes, similarities, differences, or patterns. These interviews will be compared with other data sources (observations, field notes, and documents) in order to help me understand minority representation in advanced mathematics classes.

Our interview today will be recorded using one digital device. No mention of you, your school, or your school division will be used in the report of the study. Any of your identifying information, such as your name, gender, and school affiliation will be made through a previously established code. Once our interview is completed, it will be transcribed verbatim as soon as possible. A copy of the transcription will be emailed to you for your review. When you review the transcript, you are free to make any changes in the transcription you believe are necessary. No one will have access to our interview data, your identifying information, or the transcripts from your interview, except my advisor and me. All data documents from our interview will be stored in my home in a locked file. All digital recordings of our interview will be stored in a locked file in my home and destroyed after the successful completion of the dissertation defense.

You will not be compensated for your participation in the study. The risk to you as a participant in the study is minimal. There could be some risks that you could be identified through the content of your response, but this risk to you is minimal. The benefit of your participation in this study is that your participation, combined with that of the other participants, will help other educators, policymakers, interested individuals, and me gain a deeper understanding of minority student enrollment in advanced mathematics classes.

At any time, you are free to withdraw from this study with no penalty to you. You are free not to answer any questions without penalty.

Do you have any questions? \_\_\_\_\_Yes \_\_\_\_\_No

Are you willing to become a participant in this study? \_\_\_\_\_Yes \_\_\_\_\_No

I greatly appreciate your willingness to participate in this study.

May I digitally record our interview? \_\_\_\_\_Yes \_\_\_\_\_No

Do you have any questions before we begin? \_\_\_\_\_Yes \_\_\_\_\_No

## Appendix M

### Case Study Interview Questions for Administration

#### Questions for Principal, Assistant Principal, Instructional Coach, and Director of Instruction

1. Briefly highlight the roles, responsibilities, and experiences that define your professional responsibility to student achievement in mathematics.
2. Why do you think the current math program was implemented? (1)
  - a. Based on national math and reading achievement data, mathematics tends to be an area of concern for many public school divisions. Is mathematics an area of concern for this middle school? Why?
3. What changed in the math curriculum/program when the Algebra I in eighth grade policy was implemented? (1,2)
4. Your school has success in encouraging students to take advanced classes by the eighth grade. What factors do you see as related to this success in having students take advanced math classes? (1,2)
  - a. What are the school's policies or practices for students adding, changing, or dropping mathematics courses during the school year?
  - b. How do you think this middle school addresses the issue of Black student access to advanced classes?
5. What specific policies, practices, or strategies are used to prepare sixth and seventh grade students to take Algebra I in eighth grade? (1,2)
6. What specific policies, practices, or strategies are used to support eighth grade students who are taking advanced mathematics classes? (1,2)
  - a. What are the prerequisites to enroll in an advanced mathematics class at the middle school?
  - b. Besides the prerequisites, how are students prepared for the rigor of advanced mathematics classes prior to enrolling in such classes? Specific to Black students?
7. How does the school monitor student progress? (2)
8. How does your school ensure that it hires and retains highly qualified mathematics teachers? (1,2)

9. What type of support is provided for mathematics teachers at your school? (1,2)
  - a. How is the support that is provided for mathematics teachers similar to, or different from, the support provided to other core areas teachers?
10. How did district personnel use these policies, practices, and strategies to influence students' mathematics achievement? (2)
11. What, if any, barriers might impede a school's initiative to prepare and support student enrollment in advanced mathematics classes such as high level, honors, and Algebra I? (3)
  - a. Specific to Black?
12. How is the mathematics course selection and placement information communicated to parents, students, and extended community? (1,2,3)
13. From your experiences, what steps, if any, would you have done differently in implementing the Algebra I curriculum in eighth grade? (3)
14. What, if anything, do you think that your school or your district could do differently to further encourage student enrollment and achievement, especially for Black students, in advanced mathematics classes? (3)
15. Is there any additional information that you want to share with me? Additional comments will be documented.

**Use probes as needed.** These include the following:

- Would you give me an example?
- Can you elaborate on that idea?
- Would you explain that further?
- I'm not sure I understand what you're saying.
- Is there anything else?

### **Administration**

## Appendix N

### Case Study Interview Questions for Teachers

These are the guiding questions that can be asked during the interviews with Teachers.

1. How long have you been teaching?
2. Which mathematics classes and levels do you currently teach? (1)
3. What type of support is provided for mathematics teachers at this school? (1,2)
  - a. Who provides the support?
  - b. How do these individuals know that teacher(s) need support?
4. What factors do you see that influence whether a student chooses to enroll in advanced mathematics classes in sixth or seventh grades? (1,2,3)
  - a. Are these factors different or similar for Black students?
5. What specific policies, practices, or strategies are used to prepare sixth and seventh grade students to take Algebra I in eighth grade? (1,2)
6. What factors do you see that are related to student achievement in mathematics classes? (1,2)
7. Who monitors student achievement at this middle school?
  - a. How do these individuals monitor student achievement in relationship to mathematics?
8. From your experiences, what steps, if any, do you take if you see a student struggling academically in his or her mathematics class? (1,2,3)
  - a. Are there any additional steps that other teachers might take to support struggling learners?
9. How is the mathematics course selection and placement information communicated to parents, students, and extended community? (1,2,3)
10. What, if any, are the barriers that might impede student enrollment in mathematics classes such Algebra I by eighth grade? (3)

11. What, if anything, do you think that your school or your district could do differently to further encourage student enrollment and achievement in advanced mathematics classes in sixth & seventh grades? (3)
  - a. How about Black students?
12. From your experiences, what steps, if any, could your school do differently in implementing Algebra I curriculum in eighth grade? (3)
13. Is there any additional information that you want to share with me? Additional comments will be documented.

**Use probes as needed.** These include the following:

- Would you give me an example?
- Can you elaborate on that idea?
- Would you explain that further?
- I'm not sure I understand what you're saying.
- Is there anything else?

**Teachers**

## Appendix O

### Case Study Interview Questions for Guidance Counselors

These are the guiding questions that can be asked during the interviews with Guidance Counselors.

1. Describe your primary responsibilities as a guidance counselor in this school?
2. How are the mathematics program, curriculum, course selection, and placement information communicated to students, staff and families? (1,2,3)
  - a. If academic advising occurs, when does the advising take place?
  - b. Who receives academic advising at this particular middle school (parent/students)?
3. In sixth, seventh, and eighth grades, what mathematics classes and levels of mathematics classes do students have access to? (1,2)
4. What are the specific school policies and procedures for enrolling students in honors, high level, or advanced mathematics courses? (1,2,3)
  - a. Who, in your opinion, has influence on these policies?
5. From your experiences, if any, what are some of the greatest successes and/or challenges that you see in relationship to mathematics course enrollment at this school? (1,2,3)
6. What are your school policies or practices for students adding, changing, or dropping mathematics courses during the school year? (1,2)
  - a. What are your experiences with Black students adding or dropping high level, honors, and advanced mathematics classes during the school year?
  - b. What are some of the reasons students add or drop such classes?
7. In your role as guidance counselor, what school initiatives and/or programs have you participated in that support student enrollment in advanced mathematics courses? (1,2,3)
8. In your opinion, what are the school factors that support student achievement in advanced mathematics classes such as Algebra I? (1)

9. What, if any, barriers might impede a school's initiative to prepare and support student enrollment in advanced mathematics classes such as honors and Algebra I? (3)
  - a. How about Black students?
  
10. What, if anything, do you think that your school or your district could do differently to further encourage student enrollment and achievement in sixth, seventh, and eighth grades advanced mathematics classes? (3)
  - a. How about Black students?
  
11. Is there any additional information that you want to share with me? Additional comments will be documented.

**Use probes as needed.** These include the following:

- Would you give me an example?
- Can you elaborate on that idea?
- Would you explain that further?
- I'm not sure I understand what you're saying.
- Is there anything else?

**Guidance Counselors**

## Appendix P

### School-Related Documents of Interest

Document	Category	Notes
<b>Grades 6-8 school course guide</b>		
<b>Grades 6-8 class offerings</b>		
<b>Grades 6-8 programs of study</b>		
<b>Grades 6-8 student handbook</b>		
<b>Parent notification system about course offerings</b>		
<b>Parent notification systems about registration</b>		
<b>Course brochures related to academic advising, if available</b>		
<b>Math department collaborative meeting minutes, available</b>		
<b>Division and school regulations and policies relating to mathematics programs/classes</b>		
<b>School's improvement plan</b>		
<b>Grades 6-8 school mathematics curriculum and pacing guides</b>		
<b>Data collection forms</b>		
<b>Academic assistance procedures for struggling and excelling learners</b>		
<b>School demographics and SES statistical information</b>		
<b>Grades 6-8 master schedules for teachers and school staff</b>		
<b>Professional development opportunities for 2013-2014</b>		

**Appendix Q**  
**Content Validation Instrument**

**Title of Study:** Preparing and Supporting Black Students to Enroll and Achieve in Advanced Mathematics Classes in Middle School: A Case Study

Attached is a content validation instrument. The purpose of this instrument is to improve questions that will be used on an interview protocol for principals, assistant principals, teachers, guidance counselors, and central office staff.

**Directions:**

Rate each question for its clarity by placing a 1, 2, or 3 after the question indicating your opinion of the clarity of the item.

1. Unclear, delete the item
2. Somewhat clear, but reword as suggested
3. Clear, leave as is

If you believe that a question requires rewording, place your recommendation in the column entitled “suggested rewording”. Upon completion, you may return via my email address ([bernice.cobbs@frco.k12.va.us](mailto:bernice.cobbs@frco.k12.va.us)) or I can pick up when completed.

Name \_\_\_\_\_ Position \_\_\_\_\_ Date \_\_\_\_\_

**Content Validity Instrument for Interview Questions (Principal, Assistant Principal, Instructional Coach, and Director of Instruction)**

<b>Question – Administration</b>	Domain	Unclear, delete the item (1)	Somewhat clear, reword as suggested (2)	Clear, leave as it (✓) (3)	Suggested Rewording
Q1: Briefly highlight the roles, responsibilities, and experiences that define your professional responsibility to student achievement in mathematics.	Leadership				
Q2: Why do you think the current math program was implemented?	Local, state, and federal policies  Student achievement				
Q3: What changed in the math curriculum/program when the Algebra I in eighth grade policy was implemented?	Trends Achievement Professional capacity				
Q4: Your school has success in encouraging students to take advanced classes by the eighth grade. What factors do you see as related to this success in having students take advanced math classes?	Local, state, and national trends; Achievement; Professional capacity				

Question – Administration	Domain	Unclear, delete the item (1)	Somewhat clear, reword as suggested (2)	Clear, leave as it (✓) (3)	Suggested Rewording
Q5: What specific policies, practices, or strategies are used to prepare sixth & seventh grade students to take Algebra I in eighth grade?	Professional capacity				
Q6: What specific policies, practices, or strategies are used to support eighth grade students who are taking advanced mathematics classes?	Practices; Professional Development; District school-level leadership; Teacher quality				
Q7: How does the school monitor progress?	Professional capacity; Programs				
Q8: How does your school ensure that it hires and retains highly qualified mathematics teachers?	Professional capacity; Teacher quality				
Q9: What type of support is provided for mathematics teachers at your school?	Leadership-division/ school; classroom levels; Teacher quality				

Question – Administration	Domain	Unclear, delete the item (1)	Somewhat clear, reword as suggested (2)	Clear, leave as it (✓) (3)	Suggested Rewording
Q10: How did district personnel use these policies, practices, strategies to influence students' mathematics achievements?	Policies; practices				
Q11: What, if any, barriers might impede a school's initiative to prepare and support student enrollment in advanced mathematics classes such as high level, honors, and Algebra I?	Policies; Practices; Preparation				
Q12: How is the mathematics course selection and placement information communicated to parents, students, and extended community?	Parent community; Leadership; Practices; Communication; course-taking				
Q13: From your experiences, what steps, if any, would you have done differently in implementing the Algebra I curriculum in eighth grade?	Feedback; strategies; Leadership; Frequent monitoring of data				
Q14: What, if anything, do you think that your school or your district could do differently to further encourage student enrollment and achievement, especially for Black students, in advanced mathematics classes?	District and school level leadership; Teacher quality; Professional Development				
Q15: Is there any additional information that you want to share with me? Additional comments will be documented.	Course-taking; policies; Practices; Leadership				

**Content Validity Instrument for Interview Questions (Teachers)**

<b>Question - Teachers</b>	<b>Domain</b>	<b>Unclear, delete the item (1)</b>	<b>Somewhat clear, reword as suggested (2)</b>	<b>Clear, leave as it (✓) (3)</b>	<b>Suggested Rewording</b>
Q16. How long have you been teaching?	Teacher Quality Preparation				
Q17: Which mathematics classes and levels do you currently teach?	Course offerings				
Q18: What type of support is provided for mathematics teachers at this school?	Leadership- division/ school/ classroom levels; Teacher quality				
Q19: What factors do you see that influence whether a student chooses to enroll in advanced mathematics classes in sixth or seventh grades?	Student capacity; Community ties; Professional capacity; Preparation				
Q20: What specific policies, practices, or strategies are used to prepare sixth and seventh grade students to take Algebra in eighth grade?	Professional capacity; Instructional guidance				

Question - Teachers	Domain	Unclear, delete the item (1)	Somewhat clear, reword as suggested (2)	Clear, leave as it (✓) (3)	Suggested Rewording
Q21: What factors do you see that are related to student achievement in mathematics classes?	Achievement; Preparation; Leadership				
Q22: Who monitors student achievement at this middle school?	Preparation; Instruction; Remediation; Tutoring; Resources				
Q23: From your experiences, what steps, if any, do you take if you see a student struggling academically in his or her mathematics class?	Preparation; Professional capacity; Leadership; Program; Practices				
Q24: How is the mathematics course selection and placement information communicated to parents, students, and extended community?	Barriers; Community Ties; Beliefs; Relationships; Professional quality				
Q25: What, if any, are the barriers that might impede student enrollment in mathematics classes such as Algebra I?	Course-taking; achievement				

Question - Teachers	Domain	Unclear, delete the item (1)	Somewhat clear, reword as suggested (2)	Clear, leave as it (✓) (3)	Suggested Rewording
Q26: What, if anything, do you think that your school or your district could do differently to further encourage student enrollment and achievement in advanced mathematics classes in sixth & seventh grades?	Feedback; strategies; leadership; professional capacity				
Q27: From your experiences, what steps, if any, could your school do differently in implementing Algebra I curriculum in eighth grade?	Practices; programs; policy-making; leadership				
Q28: Is there any additional information that you want to share with me? Additional comments will be documented.					

**Content Validity Instrument for Interview Questions (Guidance Counselors)**

<b>Question – Guidance Counselors</b>	Domain	Unclear, delete the item (1)	Somewhat clear, reword as suggested (2)	Clear, leave as it (✓) (3)	Suggested Rewording
Q29: Describe your primary responsibilities as a guidance counselor in this school?	Professional capacity				
Q30: How are the mathematics program, curriculum, course selection, and placement information communicated to students, staff and families?	Parent-community; professional capacity				
Q31: In sixth, seventh, and eighth grades, what mathematics classes and levels of mathematics classes do students have access to?	Course-taking; achievement				
Q32: What are the specific school policies and procedures for enrolling students in honors, high level, or advanced mathematics courses?	Leadership; practices; policies Prerequisites				
Q33: From your experiences, if any, what are some of the greatest successes and/or challenges that you see in relationship to mathematics course enrollment at this school?	Course-taking patterns; Monitoring student; Achievement; Prerequisite				

<b>Question – Guidance Counselors</b>	Domain	Unclear, delete the item (1)	Somewhat clear, reword as suggested (2)	Clear, leave as it (✓) (3)	Suggested Rewording
Q34: What are your school policies or practices for students adding, changing, or dropping mathematics courses during the school year? (1,2)	Course-taking; Policies; Practices				
Q35: In your role as guidance counselor, what school initiatives and/or programs have you participated in that support student enrollment in advanced mathematics courses?	Course-taking; Professional Development; Policies; Practices				
Q36: In your opinion, what are the school factors that support student achievement in advanced mathematics classes such as Algebra I?	Communication; parent- school connection; teacher quality; Professional Development; Leadership; instructional guidance				
Q37: What, if any, barriers might impede a school’s initiative to prepare and support student enrollment in advanced mathematics classes such as honors and Algebra I?	Teacher quality; Professional Development; Leadership; instructional guidance; school climate				
Q38: What, if anything, do you think that your school or your district could do differently to further encourage student enrollment and achievement in sixth, seventh, and eighth	Professional Development; teacher quality; Instructional guidance; Professional capacity				

<b>Question – Guidance Counselors</b>	Domain	Unclear, delete the item (1)	Somewhat clear, reword as suggested (2)	Clear, leave as it (✓) (3)	Suggested Rewording
grades advanced mathematics classes? (3)					
Q39: Is there any additional information that you want to share with me? Additional comments will be documented.					

**Appendix R**  
**Cover Letter for Participants – Content Validity Check**

Date

Mary Doe  
\_\_\_\_\_Middle School  
Anytown, VA 24095

Dear \_\_\_\_\_,

Thank you for agreeing to participate in the validation of the instrument I will be using as part of my dissertation work, as discussed during our phone call on \_\_\_\_\_. Once again, I am a doctoral candidate in the Educational Leadership and Policy Studies program at Virginia Polytechnic Institute and State University, working under the direction of Dr. William J. Glenn.

The purpose of my study is to examine and describe, using a case study design, how one middle school implemented practices and policies to prepare and support student enrollment in honors and advanced mathematics classes. The middle school focus is significant because the underrepresentation of minorities in such classes limits later student access to rigorous coursework at the high school and college levels, and even job competitiveness. Your participation will require no more than 30 minutes, and all communication regarding the content validation may be completed via email for your convenience.

Your participation in this part of my research is completely voluntary. Your thoughts will be important in helping me develop a set of questions that will deepen my understanding of minority student representation in advanced level mathematics classes. For the purpose of this study at the middle school level, advanced mathematics classes are defined as honors, high level, pre-Algebra, Algebra I, and Geometry classes. If you choose not to participate or to withdraw from this study at any time, there will be no penalty to you. While I am not able to identify every potential risk to you that may be possible as a result of your participation in this study, I do not foresee any potential risks as a result of your participation. Your responses to the content validation will be absolutely confidential. I will not identify the names of participants, schools, or divisions of those who choose to participate.

Attached to this email are the directions for completing the content validation. Please follow the directions as they are written, and return this to me as soon as you are able to do so. If you have any questions or would like to speak with me regarding the completion of this content validation check, please feel free to contact me. Again, I sincerely appreciate your willingness to be a part of this process.

Sincerely,

Bernice Cobbs, Researcher  
Virginia Tech Doctoral Candidate

540-493-6425/bernice.cobbs@frco.k12.va.us  
Telephone/e-mail

Dr. William J. Glenn  
Faculty Advisor

703-538-8493/wglenn@vt.edu  
Telephone/e-mail

## Appendix S

### Framework: Relationship of Interview Questions to Research Questions

#### Administration

Interview Question – Administration	Domain	Primary RQ: What are the policies, practices, and strategies that one middle school used to prepare and support Black student enrollment and achievement in honors or advanced mathematics classes?	Sub-question 1: What specific policies, practices, or strategies are used to encourage and sustain student enrollment in honors or advanced mathematics classes at the middle school level?	Sub-question 2: How did school and district personnel use these policies, practices, and strategies to influence students’ mathematics achievement?	Sub-question 3: If any, what barriers impede student enrollment and/or achievement in advanced mathematics classes?
A1: Briefly highlight the roles, responsibilities, and experiences that define your professional responsibility to student achievement in mathematics.	<b>Leadership</b>		X	X	X
A2: Why do you think the current math program was implemented?	<b>Local, state, and federal policies</b>  <b>Student achievement</b>		X		
A3: What changed in the math curriculum/program when the Algebra in eighth grade policy was implemented?	<b>Trends</b> <b>Achievement</b> <b>Professional capacity</b>		X	X	X <b>Implementation of policies can hinder or enhance</b>

<b>Interview Question – Administration</b>	Domain	<b>Primary RQ: What are the policies, practices, and strategies that one middle school used to prepare and support Black student enrollment and achievement in honors or advanced mathematics classes?</b>	<b>Sub-question 1:</b> What specific policies, practices, or strategies are used to encourage and sustain student enrollment in honors or advanced mathematics classes at the middle school level?	<b>Sub-question 2:</b> How did school and district personnel use these policies, practices, and strategies to influence students' mathematics achievement?	<b>Sub-question 3:</b> If any, what barriers impede student enrollment and/or achievement in advanced mathematics classes?
A4: Your school has success in encouraging students to take advanced classes by the eighth grade. What factors do you see as related to this success in having students take advanced math classes?	<b>Local, state, and national trends; Achievement; Professional capacity</b>		X	X	
A5: What specific policies, practices, or strategies are used to prepare sixth & seventh grade students to take Algebra I in eighth grade?	<b>Professional capacity</b>		X	X	
A6: What specific policies, practices, or strategies are used to support eighth grade students who are taking advanced mathematics classes?	<b>Practices; Professional Development; District school-level leadership; Teacher quality</b>		X	X	

<b>Interview Question – Administration</b>	<b>Domain</b>	<b>Primary RQ: What are the policies, practices, and strategies that one middle school used to prepare and support Black student enrollment and achievement in honors or advanced mathematics classes?</b>	<b>Sub-question 1: What specific policies, practices, or strategies are used to encourage and sustain student enrollment in honors or advanced mathematics classes at the middle school level?</b>	<b>Sub-question 2: How did school and district personnel use these policies, practices, and strategies to influence students' mathematics achievement?</b>	<b>Sub-question 3: If any, what barriers impede student enrollment and/or achievement in advanced mathematics classes?</b>
A7: How does the school monitor progress?	<b>Professional capacity; Programs</b>			X	
A8: How does your school ensure that it hires and retains highly qualified mathematics teachers?	<b>Professional capacity; Teacher quality</b>		X	X	
A9: What type of support is provided for mathematics teachers at your school?	<b>Leadership-division/ school/ classroom levels; Teacher quality</b>		X	X	
A10: How did district personnel use these policies, practices, strategies to influence students' mathematics achievements?	<b>Policies/ practices</b>			X	

<b>Interview Question – Administration</b>	<b>Domain</b>	<b>Primary RQ: What are the policies, practices, and strategies that one middle school used to prepare and support Black student enrollment and achievement in honors or advanced mathematics classes?</b>	<b>Sub-question 1: What specific policies, practices, or strategies are used to encourage and sustain student enrollment in honors or advanced mathematics classes at the middle school level?</b>	<b>Sub-question 2: How did school and district personnel use these policies, practices, and strategies to influence students’ mathematics achievement?</b>	<b>Sub-question 3: If any, what barriers impede student enrollment and/or achievement in advanced mathematics classes?</b>
A11: What, if any, barriers might impede a school’s initiative to prepare and support student enrollment in advanced mathematics classes such as high level, honors, and Algebra I?	<b>Policies; Practices; Preparation</b>				X
A12: How is the mathematics course selection and placement information communicated to parents, students, and extended community?	<b>Parent community; Leadership; Practices; Communication; course-taking</b>		X	X	X
A13: From your experiences, what steps, if any, would you have done differently in implementing the Algebra I curriculum in eighth grade?	<b>Feedback; strategies; Leadership; Frequent monitoring of data</b>				X
A14: What, if anything, do you think that your school or your district could do differently to further encourage student enrollment and achievement, especially for	<b>District and school level leadership; Teacher quality; Professional Development</b>				X

<b>Interview Question – Administration</b>	Domain	<b>Primary RQ: What are the policies, practices, and strategies that one middle school used to prepare and support Black student enrollment and achievement in honors or advanced mathematics classes?</b>	<b>Sub-question 1:</b> What specific policies, practices, or strategies are used to encourage and sustain student enrollment in honors or advanced mathematics classes at the middle school level?	<b>Sub-question 2:</b> How did school and district personnel use these policies, practices, and strategies to influence students’ mathematics achievement?	<b>Sub-question 3:</b> If any, what barriers impede student enrollment and/or achievement in advanced mathematics classes?
Black students, in advanced mathematics classes?					
A15: Is there any additional information that you want to share with me? Additional comments will be documented.	<b>Course-taking/ policies/ practices Leadership</b>		X		

## Framework: Relationship of Interview Questions to Research Questions

### Teachers

Interview Questions - Teachers	Domain	Primary RQ: What are the policies, practices, and strategies that one middle school used to prepare and support Black student enrollment and achievement in honors or advanced mathematics classes?	Sub-question 1: What specific policies, practices, or strategies are used to encourage and sustain student enrollment in honors or advanced mathematics classes at the middle school level?	Sub-question 2: How did school and district personnel use these policies, practices, and strategies to influence students' mathematics achievement?	Sub-question 3: If any, what barriers impede student enrollment and/or achievement in advanced mathematics classes?
T1. How long have you been teaching?	Teacher Quality Preparation				X
T2: Which mathematics classes and levels do you currently teach?	Course offerings		X		
T3: What type of support is provided for mathematics teachers at this school?	Leadership-division/ school/ classroom levels; Teacher quality		X	X	

<b>Interview Questions - Teachers</b>	<b>Domain</b>	<b>Primary RQ: What are the policies, practices, and strategies that one middle school used to prepare and support Black student enrollment and achievement in honors or advanced mathematics classes?</b>	<b>Sub-question 1: What specific policies, practices, or strategies are used to encourage and sustain student enrollment in honors or advanced mathematics classes at the middle school level?</b>	<b>Sub-question 2: How did school and district personnel use these policies, practices, and strategies to influence students' mathematics achievement?</b>	<b>Sub-question 3: If any, what barriers impede student enrollment and/or achievement in advanced mathematics classes?</b>
T4: What factors do you see that influence whether a student chooses to enroll in advanced mathematics classes in sixth or seventh grades?	<b>Student capacity; Community ties; Professional capacity; Preparation</b>		X	X	X
T5: What specific policies, practices, or strategies are used to prepare seventh and seventh grade students to take Algebra I in eighth grade?	<b>Professional capacity; Instructional guidance</b>		X	X	
T6: What factors do you see that are related to student achievement in mathematics classes?	<b>Achievement; Preparation; Leadership</b>		X	X	

<b>Interview Questions - Teachers</b>	<b>Domain</b>	<b>Primary RQ: What are the policies, practices, and strategies that one middle school used to prepare and support Black student enrollment and achievement in honors or advanced mathematics classes?</b>	<b>Sub-question 1: What specific policies, practices, or strategies are used to encourage and sustain student enrollment in honors or advanced mathematics classes at the middle school level?</b>	<b>Sub-question 2: How did school and district personnel use these policies, practices, and strategies to influence students' mathematics achievement?</b>	<b>Sub-question 3: If any, what barriers impede student enrollment and/or achievement in advanced mathematics classes?</b>
T7: Who monitors student achievement at this middle school?	<b>Preparation; Instruction; Remediation; Tutoring; Resources</b>		X	X	
T8: From your experiences, what steps, if any, do you take if you see a student struggling academically in his or her mathematics class?	<b>Preparation; Professional capacity; Leadership; Program; Practices</b>		X	X	X
T9: How is the mathematics course selection and placement information communicated to parents, students, and extended community?	<b>Barriers; Community Ties; Beliefs; Relationships;</b>		X	X	X

<b>Interview Questions - Teachers</b>	Domain	<b>Primary RQ:</b> What are the policies, practices, and strategies that one middle school used to prepare and support Black student enrollment and achievement in honors or advanced mathematics classes?	<b>Sub-question 1:</b> What specific policies, practices, or strategies are used to encourage and sustain student enrollment in honors or advanced mathematics classes at the middle school level?	<b>Sub-question 2:</b> How did school and district personnel use these policies, practices, and strategies to influence students' mathematics achievement?	<b>Sub-question 3:</b> If any, what barriers impede student enrollment and/or achievement in advanced mathematics classes?
	<b>Professional quality</b>				
T10: What, if any, are the barriers that might impede student enrollment in mathematics classes such as honor, high level, and Algebra I?	<b>Course-taking; achievement</b>				X
T11: What, if anything, do you think that your school or your district could do differently to further encourage student enrollment and achievement in advanced mathematics classes in sixth & seventh grades?	<b>Feedback/ strategies/ leadership/ professional capacity</b>			X	X

<b>Interview Questions - Teachers</b>	Domain	<b>Primary RQ:</b> <b>What are the policies, practices, and strategies that one middle school used to prepare and support Black student enrollment and achievement in honors or advanced mathematics classes?</b>	<b>Sub-question 1:</b> What specific policies, practices, or strategies are used to encourage and sustain student enrollment in honors or advanced mathematics classes at the middle school level?	<b>Sub-question 2:</b> How did school and district personnel use these policies, practices, and strategies to influence students' mathematics achievement?	<b>Sub-question 3:</b> If any, what barriers impede student enrollment and/or achievement in advanced mathematics classes?
T12: From your experiences, what steps, if any, could your school do differently in implementing Algebra I curriculum in eighth grade?	<b>Practices;</b> <b>programs;</b> <b>policy-making/</b> <b>leadership</b>				X
T13: Is there any additional information that you want to share with me? Additional comments will be documented.					

**Framework: Relationship of Interview Questions to Research Questions**

**Guidance Counselors**

<b>Interview Questions – Guidance Counselors</b>	<b>Domain</b>	<b>Primary RQ: What are the policies, practices, and strategies that one middle school used to prepare and support student enrollment and achievement in honors or advanced mathematics classes?</b>	<b>Sub-question 1: What specific policies, practices, or strategies are used to encourage and sustain student enrollment in honors or advanced mathematics classes at the middle school level?</b>	<b>Sub-question 2: How did school and district personnel use these policies, practices, and strategies to influence students’ mathematics achievement?</b>	<b>Sub-question 3: If any, what barriers impede student enrollment and/or achievement in advanced mathematics classes?</b>
GC1: Describe your primary responsibilities as a guidance counselor in this school?	<b>Professional capacity</b>			X	
GC2: How are the mathematics program, curriculum, course selection, and placement information communicated to students, staff and families?	<b>Parent-community; professional capacity</b>		X	X	X
GC3: In sixth, seventh, and eighth grades, what mathematics classes and levels of mathematics classes do students have access to?	<b>Course-taking; achievement</b>		X	X	

<b>Interview Questions – Guidance Counselors</b>	Domain	<b>Primary RQ: What are the policies, practices, and strategies that one middle school used to prepare and support student enrollment and achievement in honors or advanced mathematics classes?</b>	<b>Sub-question 1: What specific policies, practices, or strategies are used to encourage and sustain student enrollment in honors or advanced mathematics classes at the middle school level?</b>	<b>Sub-question 2: How did school and district personnel use these policies, practices, and strategies to influence students' mathematics achievement?</b>	<b>Sub-question 3: If any, what barriers impede student enrollment and/or achievement in advanced mathematics classes?</b>
GC4: What are the specific school policies and procedures for enrolling students in honors, high level, or advanced mathematics courses?	<b>Leadership/ practices/ policies Prerequisite</b>		X	X	X
GC5: From your experiences, if any, what are some of the greatest successes and/or challenges that you see in relationship to mathematics course enrollment at this school?	<b>Course-taking patterns; Monitoring student; Achievement; Prerequisite</b>		X	X	X
GC6: What are your school policies or practices for students adding, changing, or dropping mathematics courses during the school year? (1,2)	<b>Course-taking; Policies; Practices</b>		X	X	

<b>Interview Questions – Guidance Counselors</b>	Domain	<b>Primary RQ: What are the policies, practices, and strategies that one middle school used to prepare and support student enrollment and achievement in honors or advanced mathematics classes?</b>	<b>Sub-question 1: What specific policies, practices, or strategies are used to encourage and sustain student enrollment in honors or advanced mathematics classes at the middle school level?</b>	<b>Sub-question 2: How did school and district personnel use these policies, practices, and strategies to influence students’ mathematics achievement?</b>	<b>Sub-question 3: If any, what barriers impede student enrollment and/or achievement in advanced mathematics classes?</b>
GC7: In your role as guidance counselor, what school initiatives and/or programs have you participated in that support student enrollment in advanced mathematics courses?	<b>Course-taking; Professional Development Policies; Practices</b>		X	X	X
GC8: In your opinion, what are the school factors that support student achievement in advanced mathematics classes such as Algebra I?	<b>Communication; parent- school connection; teacher quality; Professional Development; Leadership; instructional guidance</b>		X	X	
GC9: What, if any, barriers might impede a school’s initiative to prepare and support student enrollment in advanced mathematics classes such as honors and Algebra I?	<b>Teacher quality; Professional Development; Leadership; instructional guidance; school climate</b>				X

<b>Interview Questions – Guidance Counselors</b>	Domain	<b>Primary RQ: What are the policies, practices, and strategies that one middle school used to prepare and support student enrollment and achievement in honors or advanced mathematics classes?</b>	<b>Sub-question 1:</b> What specific policies, practices, or strategies are used to encourage and sustain student enrollment in honors or advanced mathematics classes at the middle school level?	<b>Sub-question 2:</b> How did school and district personnel use these policies, practices, and strategies to influence students' mathematics achievement?	<b>Sub-question 3:</b> If any, what barriers impede student enrollment and/or achievement in advanced mathematics classes?
GC10: What, if anything, do you think that your school or your district could do differently to further encourage student enrollment and achievement in sixth, seventh, or eighth grade advanced mathematics classes? (3)	<b>Professional Development; teacher quality; Instructional guidance; Professional capacity</b>				X
GC11: Is there any additional information that you want to share with me? Additional comments will be documented.					