Rural African American Students' Narratives of Mathematics Experiences and Identity

Austin Shamar Ferrell

Follow this and additional works at: https://digitalcommons.memphis.edu/etd

Recommended Citation
Ferrell, Austin Shamar, "Rural African American Students' Narratives of Mathematics Experiences and Identity" (2024). Electronic Theses and Dissertations. 3600.
https://digitalcommons.memphis.edu/etd/3600

This Dissertation is brought to you for free and open access by University of Memphis Digital Commons. It has been accepted for inclusion in Electronic Theses and Dissertations by an authorized administrator of University of Memphis Digital Commons. For more information, please contact khggerty@memphis.edu.
RURAL AFRICAN AMERICAN STUDENTS’ NARRATIVES OF MATHEMATICS EXPERIENCES AND IDENTITY

by

Austin Shamar Ferrell

A Dissertation
Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Education

Major: Instruction and Curriculum Leadership

The University of Memphis

August 2024
DEDICATION

My dissertation is dedicated to God, my friends and family. It is because of you that I have made it thus far in my life and educational journey.
ACKNOWLEDGEMENTS

Thank you to Dr. Celia Rousseau Anderson, Dr. Alison Happel-Parkins, Dr. Beverly Cross, and
Dr. Angiline Powell for your help and guidance throughout my dissertation process.
ABSTRACT

The purpose of this study was to explore the personal narratives of five recent African American high school graduates, from several rural educational backgrounds, to understand the impact of ruralness on the construction of their mathematics learning process and mathematics identity. Narrative interviewing was used to gain valuable data which was analyzed through a qualitative thematic analytical approach and linear reconstructed narratives. General analysis of the data revealed that African American college students, from a particular university in the Southern part of the United States, who have a rural K-12 mathematics educational experience have distinctive experiences while learning mathematics. Three themes emerged after analysis of this study which were: (1) K-12 mathematics experiences are variable and context-dependent, (2) for better or worse, teacher relationships matter, and (3) positive peer relationships support mathematics learning. Each of the themes mentioned holds salience in the experiences of the African American participants in this study. The findings from this study enhance future research and practice in teaching and the field of education, especially for rural African American students learning mathematics.
# TABLE OF CONTENTS

Chapter

1. Introduction
   Overview 1
   Elementary School Experiences 1
   Middle School Experiences 3
   High School Experiences 4
   Stories of Mathematics Learning for African American Students in Rural Schools 6
   Significance of Study 7

2. Literature Review
   Overview 8
   Rurality and Rural Education 8
   The Ambiguous Meaning of Rurality 8
   Rural Education and Rural Schools 9
   Mathematics and Rural Education 12
   Mathematics Identity 12
   Mathematics Identity and Narrative Theory 14
   Race and Mathematics Identity 16
   Summary 20

3. Methodology
   Overview 21
   Research Questions 21
   Methodology: Narrative Approach 21
   Method of Collecting Data: Narrative Interviewing 23
   Participants and Recruitment 24
   Method of Data Analysis: Thematic Narrative Analysis 25
   Positionality and Ethics 26
   Positionality 27
   Ethics 28
      Consent 28
      Confidentiality 28
      Power 29
   Ensuring Quality 29
   Summary 30

4. Findings
   Overview 31
   Research Questions 31
   Participants 31
      Table 1: Participants’ Demographics 32
   The Participants’ Narratives 32
      Apollo 32
Overview of the Main Themes

Theme #1: K-12 mathematics experiences are variable (with high and lows) and context-dependent.
  Subtheme 1a: Advanced mathematics coursework promoted success and confidence.
  Subtheme 1b: Sites of struggle were often tied to specific mathematical content.

Theme #2: For better or worse, teacher relationships matter.
  Subtheme 2a: Teacher connections and relationships matter more when they are longer term.
  Subtheme 2b: Race matters when it comes to teacher-student relationships.

Theme #3: Positive peer relationships support mathematics learning.

Summary

5. Discussion
  Introduction
  Research Questions
  Discussion

RQ1: How do Black college students from rural backgrounds describe their mathematics experiences in K-12 settings?
RQ2: How does the rural context influence the mathematics identities of

vi
Black college students?

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limitations</td>
<td>80</td>
</tr>
<tr>
<td>Implications of Findings</td>
<td>81</td>
</tr>
<tr>
<td>Recommendations for Future Research</td>
<td>82</td>
</tr>
<tr>
<td>Final Thoughts and Conclusions</td>
<td>82</td>
</tr>
</tbody>
</table>

References 84

Appendix A: Recruitment Material 93
Appendix B: Informed Consent Form 94
Appendix C: Interview Protocol 98
CHAPTER I: INTRODUCTION

Overview

My experiences growing up in a very rural area had a significant impact on how I perceived the world and my identity. I grew up in a small town, where everyone knew everyone’s name and where they lived. My small town had one stop light and one school system. Each year, I had the same teachers and classes with the same classmates. This provided the opportunity for me to build strong relationships with the teachers and my fellow classmates. These relationships developed within and outside of the classroom. At the time, my school district was about 50% White, 40% Black, and 10% Other.

My earliest memories as a mathematics student are set in my two-story elementary school—Carr Street Elementary. At the time, Carr Street Elementary was home to about 250 students ranging from preschool to sixth grade, where there were two homeroom classes for each grade. Carr Street Elementary was built in 1942 and served as a small-town meeting place for our community of about 2,500 people. Each of the people in the community can probably describe a salient experience that they had at Carr Street Elementary, whether they attended the school or not. I had the pleasure of attending Carr Street Elementary from kindergarten until I went to junior high, which was a part of Fuller High School (down the street).

Elementary School Experiences

My elementary school experiences in mathematics reflect my rural school settings in a variety of ways. In third grade, I can remember sitting in class and learning my multiplication tables. I remember Mrs. Orange teaching me phrases to remember my multiplication facts. For example, we learned that “three times seven equals twenty-one angels in heaven.” Her classroom was decorated with various mathematics posters that reemphasized our multiplication facts as
well as other mathematics concepts that we had to learn in class. On the surface, this experience might look similar to that of students in other school settings. However, what was potentially different from many urban school classrooms was the fact that Mrs. Orange had taught my mom and uncles and the students in my classroom had been together for multiple years.

In third grade, I could remember being asked to go to a classroom with Mrs. Lee. She told us that we had been selected to participate in our school’s Gifted and Talented (GT) program because of our high test scores. From then on, I was deemed a “smart kid,” even though I did not really know what that meant. Each week we were pulled out of class by Mrs. Lee to participate in various activities to enhance our learning. I remember being assigned a pen pal in GT from another nearby school district (Hickman County Elementary). At the end of the year, we were able to go to Columbus Park to meet our pen pal for the first time. Although the school was only 15 minutes away, it was in a different county, which meant another school district. Hickman County Elementary School was about the same size as our elementary school, and we shared our GT teacher, Mrs. Lee, with them and two other schools.

In fourth grade, my mathematics teacher was Mrs. Blessed. Like Mrs. Orange, Mrs. Blessed had taught my mom and my uncles. She was able to get information about each of the students from Mrs. Orange and Mrs. Tucker, who were the third-grade teachers with classrooms located on the same the hallway. Again, I was in the classroom with all the same classmates. What I remember the most from my fourth-grade mathematics experience was that Mrs. Blessed held all her students accountable. Mrs. Blessed required all her students to do their homework—there was no other choice. If you did not complete your homework, she would call home and let your parent know that you would need to stay after school or during your recess to finish it.
Although I do not remember much about my sixth-grade experience, instruction-wise, I do remember completing mathematics homework outside of school. This was the first year that we were able to use a calculator (only to check our answers). I remember having my grandmother go to the store to buy a Texas Instrument-30 calculator for me. I would sit on the porch with my grandmother and work out simple expressions and equations. I remember being introduced to order of operations and using the acronym PEMDAS (parentheses, exponents, multiplication, division, addition, and subtraction) to solve problems. I also had my first Black/African American teacher, Mrs. Clemet. Mrs. Clemet was my teacher and my cousin, so she stayed in constant contact with my grandmother. Mrs. Clemet also held me very accountable to learn the content, no matter what. I remember walking up the street to my best friend Eli’s house to complete homework together. We wanted to make sure that we both had our homework complete. If we were not completing our homework in person, we were talking over the phone helping each other. When we would go to school the next day, Mrs. Clemet would ask us to go to the board to work out the problems that we completed for homework. That was my favorite thing to do—show off my mathematics skills.

**Middle School Experiences**

During my junior high years—seventh and eighth grade—I continued to grow as a mathematics student. I moved over to Fuller Junior High School, which was connected to Fuller High School. I was fortunate to have some excellent mathematics teachers in junior high that continued to push me. One of my seventh-grade math teachers was Mr. Willie. Mr. Willie had graduated with my dad from the county high school, which was about 20 minutes down the road. Every day, he would mention how much I reminded him of my dad. Additionally, my seventh-grade year was the first year that we began integrating technology into the mathematics
classroom. We began watching educational videos such as Max and Moby on BrainPOP. By
doing this, Mr. Willie was able to pique our attention.

In eighth grade, I had one of the best mathematics teachers, named Mrs. Bettie. She was
very “old school” and a traditional mathematics teacher in the sense that we were in straight rows
facing the front. We also worked out of mathematics books and had homework each day. One of
her favorite quotes was, “I have been in this business too long, there is nothing you can do to
surprise me.” Mrs. Bettie loved our school district so much; she was there for many years. She
taught my grandmother her first year at Fuller High School. She also taught my mom and my
uncles. Mrs. Bettie wanted all of her students to learn. She even kept other teachers’ children
after school for not completing their work. She always reminded us that it did not matter what
background you came from, you had the opportunity to change your trajectory.

High School Experiences

High school was the first time that my classmates and I were split up into groups—
traditional diploma route and honor students. There were two groups of traditional classes and
one section of honors classes. Something that I noticed was there were fewer students of color in
the honors section than in the traditional sections. Often, I was the only student of color in the
honors or Advanced Placement (AP) courses. It was during these years that I truly began
knowing that I was African American/Black. I began hanging out with other racial groups
outside of school and learned more about their culture as compared to my own.

In high school, I had three different mathematics teachers—Mrs. Sarah, Mrs. Dogless,
and Mrs. Sandbag. Since our high school was so small, Mrs. Sarah served as my College
Algebra, Pre-Calculus, and AP Calculus teacher, and my Spanish 1, 2, 3, and AP Spanish
teacher. I had her each year in high school. Mrs. Sarah always said that mathematics was like a
foreign language, which is why she chose to get certified in both areas. Mrs. Sarah had also taught my mom and my uncles. She would always talk about how great of a Spanish student my uncle had been as compared to me (I was a better mathematics student). Mrs. Sarah had gone to school with my grandmother at an elementary school down the road, where her dad was the principal.

Mrs. Dogless was one of the youngest teachers that I ever had. It was not usual to have a younger teacher because our teachers in the district never left Fuller Independent Schools. Instead, they would retire from the district. Mrs. Dogless was able to secure the mathematics job because Mrs. Bettie had retired. Mrs. Dogless taught me Honors Algebra I and Honors Algebra II; however, there were multiple times that I went to her for help in other mathematics classes. Mrs. Dogless’s style of teaching mathematics was innovative. I remember her teaching the quadratic formula to us through song. When she could, she would connect our learning to things outside of the classroom. I remember her telling us that both her parents and stepparents were teachers. She also had dual roles—she coached softball and served as the academic coach sponsor. I was a part of the academic team and can remember completing homework after school while waiting for the bus to arrive or preparing to host an academic match.

Lastly, I had Mrs. Sandbag for Honors Geometry. In this class, Mrs. Sandbag was very traditional too. She had taught my grandmother, mom, and uncles. She knew almost everyone in my family, and exactly where I lived (she even sent me a graduation card when I graduated). Like many of the other teachers, Mrs. Sandbag had several other roles, which included being the sponsor of Y-Club. Y-Club was a community service organization that allowed the students in it to serve their community. In addition to Geometry, I learned a lot about character through working with Mrs. Sandbag and the Y-Club.
One of my goals in telling my story is to illustrate the ways in which mathematics education in rural schools is potentially different than other settings. For example, my experience of being taught by multiple teachers who had also taught my older relatives is likely not common in other settings with higher levels of teacher turnover. Similarly, the experience of going to school year after year with the same students is another feature of rural schools that settings with higher student mobility would not experience.

In addition, my story is not only of rural mathematics education but of rural mathematics education for an African American student. Although I shared the same school setting with my White peers, my experience, particularly as I went through high school, was arguably very different, as I was frequently either the only African American student or one of a few African American students in my honors track classes. And it was also not until sixth grade that I had a teacher with whom I shared a racial background (who happened to be a relative). Thus, in telling this story of mathematics learning in rural schools, I cannot omit or overlook the role of race.

Similar to my story, this study explored stories of mathematics learning for African American students in rural schools. Specifically, the stories provided insight into the ways in which the setting interacts with the development of mathematics identity for students. The following questions below guided my research:

1. How do Black college students from rural backgrounds describe their mathematics experiences in K-12 settings?

2. How does the rural context influence the mathematics identities of Black college students?
Significance of the Study

Although researchers have begun to examine the role of identity in mathematics in general (e.g., Darragh, 2016; Langer-Osuna, 2017) and the mathematics experiences of African American students in particular (e.g., Martin, 2000, 2007; McGee & Martin, 2011; Varelas et al., 2011), there is far less research focused on the mathematics experiences of students in rural schools. This study contributes to the existing body of literature by exploring African American students’ mathematics identity within the specific setting of rural schools. In addition to this contribution to the research literature, my hope is that teachers and other educators who work in these settings will gain insights that can impact the mathematics learning experiences of other students who share a story similar to mine.
CHAPTER II: LITERATURE REVIEW

Overview

This literature review begins by describing rurality and rural education, which are critical components of this study. It is vital to define rurality and rural education through extensive scholarly research, even though the term “rurality” is often ambiguous. The literature review then describes the saliency of rural education in the context of mathematics education. Another significant component of this chapter is an overview of the concept of mathematics identity, as described in the existing literature.

Rurality and Rural Education

The interest in the topic of rural education is increasing in education research (Brenner, 2016). This is due to the need for more research conducted in this area. This section focuses on the definition of rural education and rurality and their importance to education research. This section is broken into rurality and its origins, rural schools, mathematics and rurality, and the challenges in rural schools.

The Ambiguous Meaning of Rurality

According to Balfour et al. (2002), rurality studies first emerged in agricultural sciences, agricultural education, and human geography. Much of the research focused on the sustainability of rural livelihood and the challenges and transformative nature of rurality, yet it is an understudied field of knowledge and not easily defined (Helge, 1992; Rousseau, 1995). Rural is often used as the opposite of urban in classification categories. However, many scholars argue that this classification (rural vs. urban) is limited. Moreover, neither classification has a single definition (e.g., Milner, 2012). For example, the American government uses over 15 definitions of rural, and each state has its own definition (Tieken & Montgomery, 2021). In some cases,
rural is defined with respect to the size of the population. In other cases, researchers define rural or rurality in the context of population density, proximity to urbanized areas, dealings with economic activity, income levels, educational attainment levels, and commuting patterns (Coladarci, 2007). For these reasons, it is important for researchers to situate their usage of the terms rural and rurality within a specific context (Coladarci, 2007).

**Rural Education and Rural Schools**

Many researchers have called for research that focuses on rural education (Leibowitz, 2017; Thier et al., 2021). To fully understand rural education, Howley and Howley (2014) argued that researchers must deeply appreciate rurality. The researcher must understand that rural and ruralness are much more than terms. Instead, Howley and Howley argued that the term rural is a “way of being and living” for students, teachers, and stakeholders living in rural areas and attending rural schools (p. 8). Although some rural education literature and research focus on students who live in rural poverty and teachers working in rural schools, there is more room for additional research.

Relative to the larger body of research on education, rural education is understudied. According to Leibowitz (2017), about 50% of American school districts are rural, and 33% of all schools are classified as rural, yet the research does not proportionally represent this. Over 10 years, 109,000 research articles were published, and less than 3% of those articles focused on rurality. In addition, Thier et al. (2021) pointed to a shortage of journals devoted to rural education, even though rural education represents half of the United States' school districts. Moreover, the relatively small percentage of studies focused on rural education demonstrates the need for attention to this setting (Thier et al., 2021).
Another theme of the literature on rural education focuses on the challenges experienced by rural schools. This theme has been present in the literature for over 100 years. Cubberley (1922) was one of the first known researchers to study and address the issues that rural schools faced. Cubberley described rural schools as deficient and needing significant improvements. He talked about economic changes significantly impacting rural society and institutions and argued that the changes caused efficiency to decline within rural schools.

Over the past century, rural education has changed significantly, in part due to globalization (Biddle & Azano, 2016). The number of students living in rural communities is rapidly declining, as people are moving to more urban areas. Thus, this relocation of many rural students has caused new opportunities and challenges for rural schools. According to Biddle and Azano (2016), some of those challenges include declining businesses and industries that do not allow for job opportunities for graduates, consolidation of local education institutions, and introduction of new immigrants to the areas (especially in the south). Often rural schools are faced with being the only social institution within the community and usually the largest employer. In addition, rural districts frequently suffer from a lack of funding, due to a smaller student population, and chronic teacher shortages (Harris & Hodges, 2018). Thus, while rural schools face many of the same challenges as all schools, some argue that the challenges of rural schools are unique due to their location (Arnold et al., 2005).

Tieken and Montgomery (2021) argued that there are several challenges that rural American classrooms are encountering. Although White students make up most student populations in rural schools, Logan and Burdick-Will (2017) found that several racial disparities occur. There are significant educational disparities between students of color and their White counterparts, such as a consistent racial gap between test scores and graduation rates for White
students and Latinx and African Americans (Tieken & Montgomery, 2021). Additionally, research shows that rural students are less likely to attend college and are underrepresented in 4-year programs. Tieken and Montgomery (2021) stated that these disparities occur due to the lack of resources, high rates of poverty, and ongoing school segregation.

Along with the challenges mentioned above, Tieken and Montgomery (2021) argued that one of the most significant inequalities is that rural districts are underfunded. Many rural school districts rely strictly on federal and state funds because they tend to be in high-poverty areas (Tieken & Montgomery, 2021). As a result, rural school districts tend to have strict budgets that offer little to no wiggle room. According to Mathis (2003), on average, rural schools spend about $2,000 less than their urban and suburban counterparts on students. Mathis argued that rural schools are in dire need of more funding. The lack of funding causes rural students to have limited access to advanced courses such as AP (Tieken & Montgomery, 2021). Additionally, with a tight budget, rural school districts face limited numbers of teachers due to lower teacher salaries. To offset the issue of limited courses and teachers, rural school districts sometimes work with outside education institutions to provide additional courses for their students.

According to Tieken and Montgomery (2021), many rural teachers and administrators indicate that state and federal policies do not help or fit in the contexts of rural schools. For example, Tieken and Montgomery noted that some states allow students to choose where they want to attend school (choice schools). However, due to the small population and long distances, such school choice opportunities are frequently unavailable in rural settings. Additionally, policies or mandates that require specific hiring policies for teachers can be problematic for rural schools. Rural school districts tend to have fewer funds to fill all the teaching positions required
by the state. Lastly, some rural school districts need more funding to adhere to building development and repairs mandates.

**Mathematics and Rural Education**

In addition to the need for more research on rural education in general, there is also a need for greater attention to mathematics in rural education. For example, Waters et al. (2008) surveyed the mathematics education literature. They determined that rural mathematics education, as a domain of research and body of literature, did not exist until 2001, even though mathematics education had undergone substantial changes in all settings, including rural schools. Waters et al. argued that most of the research that has been completed in the field of mathematics education has yet to focus on rural settings, policies, or practices. Similarly, Howley et al. (2005) advocated that more empirical research needs to examine rural mathematics education and communities. One of the goals of this research study is to add to the literature in mathematics education that focuses specifically on rural schools.

**Mathematics Identity**

The concept of mathematics identity has been explored by several researchers over the past two decades (Darragh, 2016). Darragh (2016) argued that an academic search for identity in mathematics education is helpful for multiple reasons, such as helping theorists learn more about mathematics learning and understanding issues of power, access, and equity in mathematics. Furthermore, Darragh stated that focusing on identity in mathematics can help researchers understand why some people connect with mathematics while others do not.

According to Aguirre et al. (2013), mathematics identity can be described as "how students see themselves and how they are seen by others, including teachers, parents, and peers, as doers of mathematics" (p.14). Additionally, mathematics identity can be defined as a person's
mathematical concept of who they are (Latterell & Wilson, 2017). Just like the idea that our identity is comprised of multiple parts or attributes, so are mathematics identities. There are multiple components of one's mathematics identity, such as their understanding of their mathematics ability, how comfortable they are with mathematics, how they have come to understand what mathematics is, and their understanding of the worth of mathematics (Latterell & Wilson, 2017).

Researchers in mathematics education have examined the concept of identity through different lenses. For example, Cribbs et al. (2015) explored the importance of mathematics identity and the impact of identity research from the perspective of students' beliefs. The researchers argued that mathematics identity is an important concept to understand and learn more about because mathematics plays a critical role in the future of all students (Cribbs et al., 2015). Furthermore, Cribbs et al. argued that mathematics is a gatekeeper to students' educational success and can immensely impact their continued pursuit of mathematics professions and careers. In addition, Cribbs et al. emphasized the impact of students' self-perceptions on their participation in mathematics.

In addition to self-perceptions, others have examined different contextual factors that can influence mathematics identity. For example, J. Wang and Goldschmidt (2003) argued that multiple factors impact students’ mathematics abilities, including the creation of their mathematics identity, which occurs during a student’s middle school years. Some factors include the courses students take in middle school, which can either help or hinder the growth of the students’ mathematics identity (J. Wang & Goldschmidt, 2003). The coursework in which students engage during middle school can also impact their mathematics achievement in high school (J. Wang & Goldschmidt, 2003). The lack of salient and meaningful mathematics classes
in middle school can cause severe inequities in the students’ high school years (J. Wang & Goldschmidt, 2003).

Another contextual factor examined in relation to mathematics identity has been school climate. Jackson et al. (2021) studied the correlation of school climate and academic outcomes for Black male students. The researchers focused on which school-based outcomes promoted the best academic identity development and math outcome for Black males. A bootstrapping analysis was used to examine 1,106 11th-grade students’ data provided in the High School Longitudinal Study. The results from the study showed that the Black male students’ mathematics identity was positively correlated with mathematics scores. Additionally, the results noted that school climate is an essential component that explains the relationship between math identity and student outcomes.

Similarly, Miller and Wang (2019) argued that mathematics identity is an essential component of mathematical development and achievement for adolescents. The researchers utilized the expectancy-value theory model, which focused on motivations. This theory is connected directly with academic identity. The researchers recruited 525 sixth-grade students, from 10 public schools in the mid-Atlantic region of the United States. Students were asked to participate in an online survey that allowed them to report their own mathematics identity. The results yielded that academic identity can be used to understand student performance and persistence in mathematics (Miller & Wang, 2019).

Mathematics Identity and Narrative Theory

In their review of the existing literature on identity in mathematics education research, Langer-Osuna and Esmonde (2017) identified narrative theory as one of the primary approaches to the study of identity in mathematics education. “As people reflect on and make sense of their
experiences in mathematical spaces, they tell stories about their mathematical selves” (Langer-Osuna & Esmonde, 2017, p. 640). From this perspective, identity is not a “real” object. Rather, identities are defined as stories. According to Lagner-Osuna and Esmode, “mathematical identities develop as people make sense of their experiences with mathematics and develop stories of success and failure and belonging or distance” (p. 639).

Similarly, Sfard and Prusak (2005) asserted that identities are stories about persons. According to these authors, individuals do not tell stories about their identities. Rather, their narratives are their identities. “We…embrace the idea of identity-making as a communicational practice and thereby reject the notion of identities as extra-discursive entities that one merely ‘represents’ or ‘describes’ while talking” (Sfard & Prusak, 2005, p. 16). They further asserted that identities are stories about individuals that are “reifying, endorsable, and significant” (Sfard & Prusak, 2005, p. 16). The narrative is considered reifying if it reflects repetitively of action. It is endorsable if the teller agrees that the story reflects the world. And a narrative is significant if it reflects membership or exclusion from various communities.

Within research taking a narrative approach to mathematics identity, one of the primary areas of focus is the concept of belonging (Langer-Osuna & Esmonde, 2017). Belonging describes the extent to which the student connects with mathematics and sees themself as a “math person” (Langer-Osuna & Esmonde, 2017) or “good at math” (Solomon et al., 2011). Belonging is also related to issues of confidence and persistence (Solomon et al., 2011). Mathematics identities have been described as “fragile” when lacking a strong sense of belonging (Solomon et al., 2011).

This identity research is noteworthy because it reflects a distinction between mathematics achievement/success and sense of belongingness with respect to identity (Solomon et al., 2011).
A student could experience academic success in mathematics but still experience feelings of exclusion or disengagement from mathematics itself. According to Boaler et al. (2000), attention to belonging as a key aspect of identity is important because it helps to change the narrative around “ability.”

**Race and Mathematics Identity**

Although the literature on identity in mathematics education approaches the study of identity in a variety of ways, one of the primary areas of existing research related to mathematics identity explores the ways in which race can shape experiences in mathematics. “From a narrative perspective, research focused on identity highlights ways in which the process of belonging to mathematics can be organized by race” (Langer-Osuna & Esmonde, 2017, p. 643). Several key research studies have told stories of mathematics identity for African American students.

One of the primary researchers in the area of race and mathematics identity is Danny Martin. Martin (2012) has highlighted the importance of race in mathematics identity development due to students of color having alternate realities to their White peers. In addition, Martin’s research has pointed to the significance of African American students’ racial identity in the learning of mathematics. For example, in his research, Martin found that many African Americans will begin their responses with "as a Black student" or "as an African American student" when discussing their experiences in a mathematics classroom (Martin, 2007). In other words, students could not separate their racial identity of being African American from their classroom experience with learning the material—they are inseparable (Davis & Martin, 2008; Martin, 2007).
Martin’s scholarship has highlighted the ways in which classroom experiences in mathematics have shaped identity. Specifically, African American students frequently have negative experiences in mathematics classrooms, impacting their mathematics identity. According to Martin (2019), Black learners have received violent forms of education and have been dehumanized in mathematics classrooms. He argued that mathematics education has been rooted in the delusion of White images, which manifests in White racial hierarchy (Martin, 2019). Martin argued that refusal to acknowledge that this occurs in the mathematics classroom exemplifies being color-blind to the racial issue.

Other researchers have also demonstrated the negative experiences of African American students in mathematics classrooms. According to Gholson and Robinson (2019), Black learners encounter and are subjected to a plethora of trauma and violence in mathematics classrooms, and these forms of trauma and violence negatively impact Black students’ mathematics learning and their mathematics identity development (Gholson & Robinson, 2019). Moreover, Gholson and Robinson argued that the relationship between Black students and mathematics is problematic and needs repair. In their study, Gholson and Robinson used a qualitative research study that focused on a restorative justice mathematics framework (mathematics for justice, identity, and meta-cognition) to combat the tension between Black learners and mathematics. For this study, students were asked to draw a silhouette of themselves. On the inside of their silhouette, they were asked to write internal messages they told themselves about mathematics. On the outside, they were to write the external messages they received about mathematics. Researchers analyzed the silhouettes and concluded that although students did not consciously say they were victims of being divorced from mathematics education, their drawings expressed disenfranchisement from mathematics education (Gholson & Robinson, 2019).
Additionally, Black students face experiences with stereotyping within the mathematics classroom. Often, this stereotyping comes from the racialized forms of mathematics in which students are forced to engage (Davis & Martin, 2008). For example, McGee and Martin (2011) discussed stereotypes against African Americans within mathematics education. Black/African American college students were interviewed in this research. These interviews revealed the significant effect of stereotype threat on Black students’ performance. Furthermore, Schweinle and Mims (2009) argued that the stereotype threat has a negative impact on African American mathematics students’ identity such as lower self-efficacy and resilience toward engaging within mathematics.

In addition to research exploring negative influences on mathematics identity, researchers have also examined various protective factors with respect to identity. For example, a study by McGee and Pearman (2014) focused on urban Black elementary students who challenged the normative deficit characterization determined or defined for students like them. Specifically, McGee and Pearman focused on what protective factors can be established to ensure that Black boys achieve in mathematics. The researchers used the phenomenological variant of ecological systems theory (PVEST) model, which focuses on the experiences of the person despite challenges that they face. The researcher interviewed 24 mathematically high-achieving Black students in high schools. The research yielded a list of protective factors to enhance the development of students’ mathematics identity and mathematics achievement.

Similarly, Berry et al. (2011) explored the ways in which racial identity of Black boys is connected to their success in mathematics classrooms. Berry et al. utilized focus group interviewing, observations, and student documents to examine the correlation between racial identity and mathematics education. Through their research, Berry et al. described three themes
that emerged as critical findings of how race intersects with mathematics identity. First, they found that the construction of a solid mathematics identity is comprised of four factors: conceptual fluency, extrinsic recognition, relational connections, and engaging with unique qualities of mathematics. The second critical finding was that racial identity in mathematics classrooms and schools is influenced and connected to the perceptions of other students, especially relating to school engagement (Berry et al., 2011). The last finding was that there is an area of “otherness” where Black students have to critically reflect on what it means to be Black while engaging in mathematics activities (Berry et al., 2011). This reflection comes from the engagement that the students have in the mathematics classroom, how they perceive other students in the classroom, and how others perceive them (Berry et al., 2011). Furthermore, through this sense of otherness, Black students can redefine their mathematics and racial identities (Berry et al., 2011).

In addition, Noble (2011) conducted a study that focused on the personal stories of African American men who performed well and excelled in mathematics. Noble’s study explored the students’ self-efficacy to be successful in mathematics and the impact and benefits it had on their motivation and mathematics academic achievement. Through his research, Noble examined autobiographies and conducted interviews with African American men. He defined self-efficacy as the way an individual, in this case, a student, inspects their performances in the classroom (Noble, 2011). His study proved that self-efficacy could be used to examine the relationships between motivation, academic performance, and achievement in mathematics classrooms (Noble, 2011).
Finally, through her research with mathematically high-achieving Black college students, McGee (2015) distinguished between fragile and robust mathematical identities. According to McGee,

The term fragile is defined as the delicate and vulnerable relationships between Black students’ mathematics success and the persistent racialization they endure in their discipline. The term robust is defined as the strength and agency that students develop in spite of their racialization to maintain self-motivated mathematics success (p. 604).

This framework of mathematics identity focuses: (1) motivations to succeed in mathematics; (2) coping strategies in response to racialized experiences in mathematics, and (3) dispositions associated with successful outcomes. According to McGee (2015), students’ identities are either mostly fragile or mostly robust, although they change in different situations and time periods. McGee’s research involving this framework provides insight into the ways that African American students’ sense of belonging in mathematics is context-dependent and influenced by racialized experiences.

**Summary**

The research reviewed in this chapter highlights the importance of mathematics identity. In addition, I have shared an overview of much of the existing research on the mathematics identity of African American students. Yet, little of this research has explored the experiences and mathematics identities of African American students in rural schools. Using narrative theory lens to understand identity, I explored the experiences of African American rural students and the ways that their identity stories reflect the influence of the rural school setting.
CHAPTER III: METHODOLOGY

Overview

This research is focused on how rural African American students construct their identity in mathematics. Moreover, I took a narrative approach in this study to understand the role of identity in rural mathematics education. In this chapter, I describe how I conducted the study and analyzed the narratives that I collected.

Research Questions

My research was guided by two main questions:

1. How do Black college students from rural backgrounds describe their mathematics experiences in K-12 settings?

2. How does the rural context influence the mathematics identities of Black college students?

Methodology: Narrative Approach

This study was grounded in narrative inquiry. Narrative inquiry is based on the assumption that stories “are one, if not the, fundamental unit that accounts for human experience” (Clandinin, 2006, p. 4). According to Clandinin (2006), “Human beings have lived out and told stories about that living for as long as we could talk” (p. 35). Through stories and lived experiences, people have been able to find meaning and understand the worlds of others (Clandinin, 2006). The notion of understanding others’ stories and lived experiences has been introduced to the field of research through the term known as narrative inquiry or narrative approach, which is the approach that I used for my methodology. Within this section of the chapter, I define narrative approach and described its saliency in my research.
Narrative inquiry is a form of qualitative research that focuses on human lives as woven stories (Clandinin & Connelly, 2000). Narrative inquiry begins with human experiences in the forms of lived and told stories (Clandinin, 2006). Furthermore, narrative inquiry occurs when qualitative researchers use stories, narratives, or even descriptions as a way to research and learn about human lives and experiences (Clandinin, 2006; Clandinin & Connelly, 2000).

In addition, narrative inquiry “embraces narrative as both the method and phenomena of the study” (Clandinin, 2006, p. 5). Narrative inquiry uses lived stories and told stories to begin research—a starting point for researchers as they begin to understand the experience of other individuals (Clandinin, 2006). In addition, qualitative researchers also use narrative inquiry to tell a story or narrative within their research (Clandinin, 2006). Thus, narratives serve as both the site of inquiry and the product of that inquiry.

A primary purpose of my research was to understand the mathematics experiences of Black students in rural schools. Because I sought to have the participants reflect on their individual histories, it is natural for these experiences to be communicated in stories. The concept of storytelling served as a way for me to amplify the participants’ voices based on their experiences and tell their “truths” (C. C. Wang & Geale, 2015). For my research, narrative inquiry was appropriate because of its seamless alignment to storytelling and narratives (McAlpine, 2016). Through storytelling, my participants described their identities and experiences as African American mathematics students in rural classroom settings (McAlpine, 2016). Through storytelling, participants discussed their past and where they were currently as it related to their mathematics education experiences (McAlpine, 2016).
Method of Collecting Data: Narrative Interviewing

Narrative interviewing worked together cohesively with my research. Varelas et al. (2013) stated that the stories or narratives from participants can be used to develop information or data that can describe who the participants are and their position within the classroom. This was essential because narrative interviewing allowed for the research to paint a picture about my participants’ experiences.

Narrative interviewing served several purposes in this study. One of the primary purposes of using narrative interviewing for this research design was that it allowed the participants to revisit their past experiences. It was essential to create interview questions that required the interviewees to reflect and remember past experiences (Muylaert et al., 2014). My interview questions were framed in a way that asked the participants to recall their experience with mathematics content and reflect on that experience to determine how they constructed their mathematics identities. Additionally, narrative interviewing allowed participants to be owners of their stories. It was essential to know and understand that I was not the owner of the experiences of the participants; rather, I was sharing the participants’ experiences through my research (Muylaert et al., 2014). Lastly, as the researcher, I created a narrative based on the participants’ experiences with their help (Muylaert et al., 2014).

I conducted interviews, one-on-one, with the college students who opted in to participate. The interview was semi-structured, which means that I had some questions ready to ask participants (Wengraf, 2001). I had a guide with the questions and topics that needed to be covered (Harrell & Bradley, 2009). My questions were placed in a specific order; however, at my discretion I asked some questions out of order (Harrell & Bradley, 2009). I asked probing questions to ensure that my participants fully answered each of the questions that I asked (Harrell
& Bradley, 2009). Furthermore, the semi-structured interviews allowed me to take a deep dive into the information that I wanted to know from my participants (Harrell & Bradley, 2009). My goal was to prompt participants to tell a story about their experience and their mathematics identity by asking them to reminisce on their history in mathematics (Josselson, 2013; Wengraf, 2001). Each of the students’ narratives was different.

As I interviewed the participants, I recorded their responses with a recording device and took some shorthand notes. By using a combination of recording and brief notes, I ensured that I focused my attention on the participants’ responses. Following the interviews, I transcribed the recordings. Both the audio files and transcriptions were stored in password-protected OneDrive folders and identified only by pseudonym.

**Participants and Recruitment**

I recruited five African American college students for this study. The participants that were a part of this study attended a rural university in the Southern part of the United States. Each of the participants identified as African American. Before attending the university, each participant attended and graduated from a rural high school. For the purpose of this study, I used the term “rural” to include a town or city with a population less than 15,000 people that was 50 miles or more from a major urban city. Some examples of rural schools meeting these criteria were Fulton Independent Schools, in Fulton, Kentucky, and Martin Westview High School, in Martin, Tennessee.

I began recruitment for the study by asking the director of multicultural affairs at a rural university in the Southern part of the United States (my employer) to send out an email on my behalf via his listserv (Appendix A). However, another critical requirement to participate in my study was that the student could not be one of the current students in the program for which I
served as director. Additionally, they could not be a current student in one of my classes or one of my advisees. My goal with these exclusionary criteria was to ensure that students did not feel coerced into participation. Although I was prepared to utilize additional recruitment strategies, if needed, the email yielded five qualified participants.

**Method of Data Analysis: Thematic Narrative Analysis**

Thematic narrative analysis was the method by which I analyzed the data that I received via narrative interviewing. Kim (2016) defined narrative analysis as a mode of analysis that is “based on narrative cognition that attends to the particular and special characteristics of human action that takes place in a particular setting” (p. 197). Narrative analysis not only functions as a “method through which researchers explore how people remember, structure, and study their experiences” (Esin, 2011, p. 95). Narrative analysis also lends researchers the opportunity to understand the complexities of humanity, human lives, and their relations (Esin, 2011). Through narrative analysis, the researcher “integrates the individual details and complexity in the construction of stories” (Esin, 2011, p. 95).

Narrative thematic analysis focuses on how the narrator or participant makes meaning of their life experiences while sharing their narratives with the analyst (Esin, 2011). In this case, my participants shared their experiences of learning mathematics as African American students in a rural K-12 setting. As the analyst, I listened to the detailed experiences of the participants and made a “systematic interpretation” of the narratives that the participants shared with me. My goal was to understand their mathematics identities as narratives.

There are several forms or models of narrative analysis. However, I used thematic analysis. The thematic narrative analysis focuses mostly on the content of the narratives that are provided by the participants and the themes that emerge from the narratives that are told (Esin,
According to Riessman (2008), thematic narrative analysis differs from other forms of analysis through the focus on the “intact” story. Within thematic analysis, the researcher seeks to preserve the narrative sequence, rather than breaking the story apart and coding segments (Riessman, 2008).

The first step in the process of thematic narrative analysis for this study involved the transcription of the interviews. For this study, I anticipated that the interviews would generate a form of “life story” regarding the participants’ experiences in mathematics (not unlike my own story shared in Chapter I). However, the mathematics life story did not unfold in the interview in a strictly linear or chronological form. Following transcription, the next step involved the construction of each individual’s narrative account from the interview transcriptions to create a more linear narrative from their data by rearranging their stories in a chronology.

Once the narratives had been reconstructed, thematic categories emerged based on the participants’ stories. While keeping the narrative sequences intact, I sought to understand the emerging themes regarding African American mathematics identity in rural schools. By doing this, I created more linear narratives from their stories, and then identified emerging themes from their stories to better understand what some of their shared experiences were.

**Positionality and Ethics**

When writing a dissertation or creating a research proposal, researchers must pay great attention to their research positionality because it affects their ethics while conducting research (Sultana, 2007). In addition to positionality, understanding the ethics in the study is a critical task of the researcher. Positionality and ethics play critical roles in a researcher's proposal and dissertation. Researchers must know and understand how to identify and articulate their positionality and ethics throughout their research (Darwin Holmes, 2020).
Positionality

Researchers must think of their own positionality when conducting research. Positionality is a term that refers to the researcher’s worldview and the position that they take or adopt on the research task (Darwin Holmes, 2020). The researcher’s positionality is derived from their lived experiences, worldview, and assumptions (Darwin Holmes, 2020). All of these components must be considered. Additionally, the researcher’s thoughts, feelings, mental health, and other aspects of self-identification are components of how their positionality is developed (Secules et al., 2021). Not only does positionality focus on the ideas of the author, but it can affect the research. Positionality reflects and influences how the researcher will conduct the study, the outcomes, and the results (Darwin Holmes, 2020).

For this research study, my positionality impacted my study. As described in the opening of Chapter 1, I graduated from a rural school district, where ruralness greatly influenced my identity and understanding of mathematics. I identify as an African American male who had a great experience in a rural education setting. Additionally, rural education holds a special place in my heart since I had the opportunity to experience it. In addition, I also served as a middle school mathematics teacher in a rural setting with a student population that was 95% African American.

I worked very hard to ensure that I critically self-reflected on how to prevent my own experiences and beliefs from overly influencing how I interacted with the data. To do this, I kept a researcher journal, where I reflected on my own beliefs and reactions so that I could stay immersed in the data. As the researcher, utilizing the journal helped keep me from allowing my preconceived ideas to influence how I made sense of the interview data.


**Ethics**

Ethics plays a crucial role in research. Researchers must consider some areas throughout the research process such as consent and confidentiality (McNamee, 2001).

**Consent**

The consent of my participants was critical. Consent is when the participants permit the researcher to conduct research on and with them. McNamee (2001) stated it as, “asserting that the subjects of research have the right to be informed of the nature and purposes of the research and autonomously to choose whether to participate in it” (p. 310). For my research, I created a document for my participants to ensure that I had consent from them (Appendix B). In my consent form, I stated the reason for conducting the research, asked my participants for permission to be a part of my research, described how my research would be used, and stated the way that I protected my participant's identity. Additionally, I provided my contact information as well as the university’s.

**Confidentiality**

Another essential component of ethics for my research was confidentiality. Confidentiality is the process of keeping material secret or private. According to Morse and Coulehan (2014), protecting participants’ identity confidently is the core tenet of research ethics. Maintaining confidentiality in the research is beneficial to the participants and protects them from potential backlash after the study is written. One way that I protected the names and the identities of the participants was that I allowed my participants to pick a pseudonym. Additionally, I gave multiple tags to help identify the participants instead of using their names (Morse & Coulehan, 2014). By labeling my student participants with tags instead of their names,
I focused on demographic information and material learned from the participant in the research process.

**Power**

The idea of power is an essential part of both ethics and positionality. In most studies, the researcher is seen as having power over the participants. It was understood that as the researcher, I had intrinsic power. However, it was critical that I was very mindful of this, and I did whatever I could to ensure that I lessened the power differentials by being transparent throughout the entirety of the research study.

**Ensuring Quality**

Ensuring quality is a critical element of any research study. There are several core concepts that are embedded in qualitative research that work together to ensure that the researcher “breaks free from positivist notions of quality and embraces a broader conception of quality for a qualitative study” (Savin-Baden & Major, 2013, p. 470). To ensure quality was met for my research study, I used member checking. Member checking is described as a strategy where the researcher checks with their participants for feedback on the interpretation of the data (Savin-Baden & Major, 2013). For my study, I reached back out to each of the participants twice to receive their verification or feedback on my interpretation of the data (the constructed linear stories and identity statements). Through this member checking, I allowed my participants to have a voice in the research, and it is considered to be more credible (Savin-Baden & Major, 2013). This also allowed for the participants to correct any misunderstandings or misrepresentations that I might have developed through the research (Savin-Baden & Major, 2013).
As mentioned previously, I kept a researcher's journal that helped me with critical self-reflection. The journal was used to track all of my methodological decisions and create an audit trail. Alongside the journal, I worked closely with my dissertation committee to ensure that my data analysis stayed close to the data. Doing this allowed my committee to do a quality check to ensure that I was not interpreting the data based on my own experiences and positionalities.

**Summary**

The goal of this chapter was to describe the methodology and methods that I utilized in this dissertation. Because I sought to understand the experiences of African American students who attended rural schools, I utilized a narrative approach and collected data through narrative interviews. My participants included college students who attended rural K-12 schools. These students were interviewed about their experiences in mathematics and a story of these experiences was created with their help. While each story was unique, I analyzed the narratives to understand how the participants’ mathematics identities as rural African American students developed.
CHAPTER IV: FINDINGS

Overview

This chapter presents the findings produced by the analysis that I completed. I will highlight how the African American participants understood and talked about their experiences learning mathematics in rural education settings. Chapter IV begins by restating the research questions that have guided this study. The chapter then provides background information about each of the participants in the study. Additionally, through this section of the dissertation, I will introduce the participants and present the emergent themes from my research. My analysis suggests that there are three main themes. Each of the themes is supported within this section of my dissertation with quotes from the participants from the interview.

Research Questions

My research is guided by two main questions:

1. How do Black college students from rural backgrounds describe their mathematics experiences in K-12 settings?
2. How does the rural context influence the mathematics identities of Black college students?

Participants

The five participants from this study were all current students (undergraduate and graduate) at a university in the Southern part of the country. Each of the participants had to meet the following additional criteria: identify as African American and must have attended and graduated from a rural high school.

Table 1 includes information about the participants, including their selected pseudonym, age, gender, classification, and general location of hometown. It is worth noting that the five
participants represent rural areas from three different states. In addition, although the three participants from State A were from the same general area of the state, they represented two different communities.

**Table 1**

*Participants’ Demographics*

<table>
<thead>
<tr>
<th>Participant’s name</th>
<th>Age</th>
<th>Location/Area where participant grew up</th>
<th>Gender</th>
<th>College classification [credits wise]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apollo</td>
<td>21</td>
<td>Northwestern part of State A</td>
<td>M</td>
<td>Senior</td>
</tr>
<tr>
<td>Darius</td>
<td>19</td>
<td>Northwestern part of State A</td>
<td>M</td>
<td>Sophomore</td>
</tr>
<tr>
<td>Frank</td>
<td>20</td>
<td>Northwestern part of State A</td>
<td>M</td>
<td>Junior</td>
</tr>
<tr>
<td>Nevaeh</td>
<td>23</td>
<td>Southwestern part of State B</td>
<td>F</td>
<td>First semester graduate student</td>
</tr>
<tr>
<td>Rosa</td>
<td>22</td>
<td>Northwestern part of State C</td>
<td>F</td>
<td>Senior</td>
</tr>
</tbody>
</table>

**The Participants’ Narratives**

As mentioned in Chapter 3, each of the participants selected a pseudonym that I utilized throughout the study for the protection of their identity. Furthermore, I believe that it is essential to provide the participants’ background stories within my dissertation. Each of their stories has been member-checked to ensure the most authentic narrative.

**Apollo**

Apollo grew up in a small town with a population size of about 4,000-5,000 people. Apollo’s hometown was home to a small private university. As a result, the town is more widely known than other communities of its size. The town was surrounded by farmland, with a traditional downtown area, and had a strong southern feel to it. In addition to the farmland, there
were several hills and lakes. Many of the people lived on the outskirts of town on small farms beside lakes.

In his school, Apollo had a graduating class of about 90 students (similar to each of the other grades), and everyone knew everyone. All of his friends went to school together from elementary, middle, and high school, and each of the schools was not far from the others. Similar to the small school, Apollo’s town was one where everyone was familiar with each other. The small town was not very diverse, and the majority of families who lived there were White. The town could even be said to have a racial divide. Even though people of color were the minority, both in school and in his community, Apollo had friends from diverse racial and ethnic backgrounds.

Apollo lived with his mom and dad and his three older siblings. All three of his siblings performed very well academically in mathematics. A lot of people in the community knew Apollo because of his parents—his mom was a teacher and his dad worked in human resources. Often Apollo’s Black friends had issues with race in the community; however, he did not because of the relationships that his parents had in the community. Additionally, Apollo was sheltered from a lot of things, such as racism and discrimination, that would be considered harmful to other African American students in town because of his parents.

**Elementary Experiences.** In Apollo’s house, it was unacceptable to make anything less than a B in any class, so he always strived to make A’s. Often, he was compared to his brother who was more mathematically inclined, which made Apollo feel sad. He knew that he was much stronger in English and reading. Although Apollo did not struggle in mathematics in elementary school, the content often made him frustrated due to his making some simple mistakes. During his elementary years, Apollo would score in the top percentile of his class.
Apollo attended the only elementary school in his town, which was located right in the center. On the outside of the school, there was a small football field that separated the elementary school from the middle school. The elementary was very small and had three hallways. One hallway contained the library and cafeteria, while the other hallways contained the classrooms and other offices. Before the school was used as an elementary school, it was the old high school for his district.

In elementary school, Apollo remembered seeing some Black and Hispanic students, but the majority of the students were White. Additionally, there was one Asian family in the school. Due to a high faculty and staff retention rate, Apollo had several teachers that his mother worked with and that taught his siblings while they were at the same school. Every faculty and staff member knew each child no matter what grade they were in. The elementary school housed prekindergarten through fifth grade. In school, Apollo had self-contained classrooms until third grade. Starting in third grade, the teachers were departmentalized and taught specific subjects. Apollo also recalls not seeing any Black teachers in the school other than his mother. Therefore, Apollo did not have any Black/African American educators teach him in elementary school.

Apollo’s first memory of learning math was his third-grade year when they began to subtract 3-digit numbers with Mrs. Martha, who was White. Regrouping was a concept that was fairly new to him during that year. At the beginning of the lesson, he asked the teacher how to subtract 3 digits because he had not seen it before. Apollo’s teacher, in a rude way, said “What do you mean you haven’t seen this before? You do it the same way you usually do it.” Apollo was frustrated and upset, wondering how he could have forgotten that he learned something such as that. Later in the same lesson, the teacher saw that multiple students were
struggling and apologized to the whole group because no one had done 3-digit subtraction before. That recognition made Apollo feel relieved.

In fourth grade, Apollo’s teacher, also White, taught them the basics of order of operations. During this time, the math problems began getting longer and having more steps than just adding and subtracting. Apollo became frustrated with mathematics in fourth grade because math was never his strong suit and completing complex problems such as order of operations was not sticking.

**Middle School Experiences.** Apollo’s middle school was located across a field from his elementary school. Similar to the elementary school, the middle school was very small and did not have any African American teachers. The students and friends that Apollo had in elementary school followed him across the field to middle school. Apollo’s middle school had a hallway for fifth and sixth grades and a hallway for seventh and eighth grades. Fifth and sixth graders did not cross paths with seventh and eighth graders. Each grade had a few pods where students would travel together throughout the day. Apollo had class with the same students all day in his learning pod. The only free time that Apollo had away from his pod was during lunchtime. Additionally, Apollo loved the school library and spending time there in middle school. Reading has always been his passion. This was the same for his friends in middle school. Apollo and his friends would often meet in the library to study.

In middle school mathematics, he began relying more on the tricks that he learned. Math had become more complex, and he was able to find ways to make it easier to understand and learn. Apollo grew more anxious about math in middle school because concepts such as positives and negatives began to emerge in the content. Apollo began going to tutoring for math
to ensure that he understood what he was learning. Tutoring helped bridge the gap of the missing pieces from the lesson in class.

Apollo had a White sixth-grade math teacher who helped build his confidence. She urged him to continue to try math, even when it's hard, which was an ideology that he still takes with him today. During middle school, Apollo felt very confident in mathematics because he felt that he had mastered it. He attributed this to his teacher’s instructional strategy. Each day Apollo brought a composition notebook to class where he took several notes that he went home and reviewed. This was a requirement of his teacher. Apollo’s notebook also included personal notes that he made as he began learning the material. Additionally, Apollo’s teacher made him and the other students feel confident because she would stay on material until they mastered it. They sometimes would stay on a subject for 1 to 2 weeks if needed.

In middle school, Apollo also began to see how his peers had begun struggling in mathematics. Although Apollo shared some of these struggles, his teachers knew his parents and were more than willing to help him. Apollo had stronger relationships with his middle school teachers than his other African American peers. Because they knew his mom was a teacher, Apollo’s teachers ensured that they always answered questions that he had in class. This was not the case for his friends. Apollo began seeing his friends become disengaged from math.

**High School Experiences.** Apollo attended the same district for high school, and the demographics of teachers were the same. Most of his friends from elementary school and middle school followed him. The high school was down the road from the elementary and middle schools. Apollo’s high school was the newest of the buildings and it was bigger than the other two schools because it included a larger gym, a theater, and even two libraries. While the other
two schools were considered to be in town, Apollo’s high school was on the outside of town surrounded by corn fields.

In the school, there were three hallways. There was a freshman and sophomore hallway, junior hallway, and senior hallway. As with middle school, a place in the high school that Apollo enjoyed was the library. It was there that he got his peace and was able to do his schoolwork in his spare time. Lastly, Apollo was heavily involved in several clubs and sports in school such as football and theatre.

Apollo took several math courses throughout his high school experience. A common course that all students took until their junior year of high school was ACT prep, which included ACT math. Apollo began to struggle in high school with mathematics because he was a Distinguished Scholar, which required him to take additional upper-level mathematics courses. Apollo was considered an honors student in high school because of the academic track that he took. In Apollo’s honor courses, there was a mixture of students from various grade levels. Most of the courses prepared him for college and were considered to be very rigorous.

Apollo’s first two years of high school math were easier for him than the last two. However, Apollo did not think that his Geometry teacher during his freshman year was the best. She did not teach all of the concepts and material that Apollo would need to move forward in mathematics. Therefore, Apollo spent most of his sophomore year relearning the content from the year prior. During his sophomore year, math became more complex with the inclusion of more word problems.

It was during his junior and senior years of high school that math became hard for him. Apollo took Pre-Calculus and Calculus, respectively, and he had the same teacher for both courses. Apollo earned his first C in Pre-Calculus in his junior year. In Pre-Cal, Apollo
went to class to take a test, and he did not know anything about it. He remembered working on similar questions in class but forgot how to do it on the actual Pre-Cal test. In both classes, Pre-Cal and Calculus, his teacher tried to keep him and his classmates very organized. However, no matter how organized he was, the math continued to get more and more difficult. Apollo struggled the most with Calculus proofs his senior year. Often, he would meet some of his peers during first block to study Calculus notes, check homework, and prepare for quizzes in the library. He and his friends knew to be prepared for Calculus second period, they had to work together. However, often when they made it to class, Apollo and his friends would second guess themselves.

During his senior year, there were several times that Apollo cried over not knowing how to complete his math work. As he cried alone, he would often think and say that the math did not make sense to him. There were multiple times when Apollo could not figure out how he got a problem wrong on his homework or test, even though he had tried to study for this course over the summer. After several failed quizzes in Calculus, Apollo finally went to the teacher and let her know that he was struggling. Before going to the teacher, Apollo wanted to give up on Calculus. Apollo could not wrap his mind around the idea of not being able to understand the concepts of Calculus—it kept eating at him. When Apollo went to this teacher, who was White, after being stumped for a while, she told him that he needed to slow down when working out his problems. This information helped Apollo because he began slowing down and thinking about the steps in his problems rather than speeding through the problem.

Apollo’s Mathematics Identity. Although Apollo experienced academic success in mathematics, this did not necessarily translate into a sense of belonging (i.e., being a “math person”) throughout his K-12 trajectory. However, his 6th grade teacher had a positive influence
on his confidence in mathematics. And he demonstrated persistence throughout high school in the face of challenges with the increasingly more advanced mathematics content. Thus, although his sense of belonging and connection to the mathematics content was not strong throughout his K-12 experience, he was able to demonstrate academic success and persistence in mathematics.

*Darius*

Darius grew up in a very small town with about 3,500 people. Darius’s town had one red light and if you blinked, you would miss it. When thinking of his community, Darius not only described his town, but he described his county as a whole. Darius’s community was so small that they did not make a distinction between the two towns that made up the county. Darius’s community was known for its lake. The lake was the main attraction. People came from miles away to take tours, to eat, and to fish on this lake. In addition to business relating to the lake, agriculture played a critical role in his community. Darius’s town did not have much violence, and everyone knew everyone. Because of that, Darius and the other children growing up in the community had to always be on their best behavior because, if they were not, their parents and guardians would be informed of their misbehavior. Darius was no different; he was always afraid to do anything bad because he was afraid that his mom would find out. Darius and the other people in the community thought this was a great thing because everyone in the community was always willing to help one another. Darius described the community as very friendly and accepting of all people.

Darius was a middle child and had three older siblings and three younger siblings, all of whom had attended the same school district. Therefore, his mom had met and knew some of the teachers in the district already. Darius also had a mentor who pushed him to do well in school and life, which included mathematics. Darius did not want to let his mentor down, so he always
tried his best to be successful in school and stay on top of his grades. The district that he and his siblings attended had one elementary school, one middle school, and one high school. In each of the graduating classes, there were about 50 students. These students had grown up with one another throughout their entire K-12 experience. There were not many students coming into the school district or leaving out.

**Elementary Experiences.** Darius’s elementary school was a very old building with one hallway that included all the classrooms, the gym, and the cafeteria. In that hallway, classrooms were grouped based on their grades. For example, the fourth- and fifth-grade classrooms were close together. Similar to the community, Darius attended an elementary school where all the students, teachers, staff, and administrators knew each other. In the school, there was one Black female teacher (which he had), but there were some additional support staff who were Black. According to Darius, the school was located in a very nice (affluent) neighborhood in the community. Growing up in such a close-knit elementary school allowed for strong relationship-building and an atmosphere in the school that could be described as fun.

Darius’s earliest memory of mathematics was in kindergarten. Darius has always been good at math. Even in kindergarten, Darius was an advanced student in math and was ahead of his peers. Learning how to add and subtract with his teacher Miss Tamika, who was the only African American teacher that he had in his K-12 experience, was one of Darius’s earliest memories. Miss Tamika understood that Darius was advanced in math and often pushed him to be better by providing him with assignments that enriched his understanding and propelled him to the next level. To this day, Darius and Miss Tamika still talk to one another. She always let Darius know how proud she was of him.
In addition to Darius remembering learning to add and subtract in kindergarten, he also engaged with learning multiplication and division in third grade. Darius was always one of the top leaders in the games that they played to remember their multiplication and division facts. Darius’s White third-grade teacher would let the class have races and competitions to see who could work a math problem the fastest. Darius and his friends loved doing this because they were learning and having fun at the same time. Not only was this fun, but it also helped Darius in the long run. Throughout the rest of his elementary school experiences, not only could he work out mathematics problems correctly, but he could also do them quickly.

Darius loved mathematics and his teachers’ tactics to help him learn mathematics. When learning multiplication, Darius was allowed to go to the treasure chest multiple times because he received the highest grade on various assessments and assignments. Going to the treasure chest was one of the extrinsic motivations that pushed him to do well in elementary school.

**Middle School Experiences.** Darius’s middle school was located in a different community than the elementary school and was very close to the highway. The middle school was the only school in this specific community. Like the elementary school, the middle school was in an older building. But the middle school had received some renovations. Similar to his elementary school, Darius’s middle school had one hallway. In addition, his middle school had two gyms, with one of them being recently built. The newer one was built to ensure that students had a modern gym. The older gym still had wooden seats in it. Additionally, his middle school teaching staff was not diverse. There were no African American teachers teaching there.

Darius learned from the same White middle school teacher throughout his middle school experience (sixth through eighth grade). The same teacher delivered the mathematics content to the same students each of those years, just increasing the content and rigor as students moved up
a grade. Darius’s teacher made him feel confident in math each year. In addition to his teacher, Darius also was supported by his peers in middle school. His peer support made it easy for him to do well in all his courses.

**High School Experiences.** The high school was directly across the street from the elementary school. Like the elementary school, the high school was a very old building. But instead of one hallway, the high school had two. The high school also included an upstairs, but the school did not use it. Although Darius’s high school was one building, it had an older side and a newer side. Darius did not have any Black teachers but had coaches and support staff that were present in the school.

In high school, Darius had the same White mathematics teacher for all his content courses (Algebra 1, Geometry, and Algebra 2). So, his teacher had a chance to know what Darius’s abilities were as related to mathematics. Darius loved to learn from hands-on activities in high school. Although the classes began to become a little more difficult, he did not mind it because he had the support and help of his teachers. Darius did not mind asking questions from his teacher or peers because he wanted to make sure that he understood the content and material in which they were engaging in class. His relationships with his teachers and peers allowed for transparency when he did not understand something.

In high school, Darius and his peers began engaging with more technology. They each had Chromebooks as a resource to enhance their learning in their classes. In addition, he began taking dual credit courses, which included Statistics, which was taken through Zoom. During his senior of high school, Darius took Statistics with a community college that was close to high school. Even though Darius was good at mathematics, he wanted to try to get his mathematics classes completed before going to college because it was not necessarily his
favorite subject. Although Darius felt prepared to take the course, Statistics was a form of mathematics that he had never seen until that year.

Darius was first challenged with mathematics when he took Statistics. He and his classmates were so shocked that they had to take Statistics their senior year of high school, that they gave each other disappointed looks. Those looks continued throughout the course because of the content that was being taught. In the middle of the lesson when the professor would say something that they did not understand, Darius and his peers would look at one another. Statistics was a math like none other that he had taken because it required some word answers, responses, or educated guesses. There was even a time that Darius took a test in Statistics and did not know any of the answers, so he tried his best and just went with his instincts on the problems. To ensure his success in the course, not only did the instructor from the college help Darius and his peers, but the math teacher from the school also helped. His high school math teacher served as the bridge between the college class and high school. It was because of Darius’s persistence in this course that he earned a B and did not have to take a mathematics class in college. Although Darius was good at mathematics, it was not his favorite subject, which is why he wanted to have it completed.

Darius’ Mathematics Identity. Darius experienced great success in mathematics throughout his K-12 experience and viewed himself as a “math person.” He displayed a knack for numbers and a strong sense of confidence throughout his K-12 experience. Although he was challenged in Statistics, this did not seem to shake his overall sense of belonging in mathematics and view of himself as good at math. It is important to note, however, that his connection to mathematics did not extend beyond his K-12 schooling experiences, as he did not take mathematics classes in college.
Frank was from a small town. The biggest store in Frank’s town was Food Rite. Frank’s hometown was known for the three F’s: farming, fishing, and football. The town was very much known for its famous lake that attracted many guests throughout the year, whether it was for touring, boat riding, eating, or fishing. In addition, the town was known for its agriculture and farming. There were rows and rows of farms that surrounded the town. Lastly, people in Frank’s hometown loved football and the local high school football team, of which he was a member in high school. Now that Frank was in college, he gave back by working with the same high school football team.

Frank’s community was one in which everyone knew everyone. Frank’s family was well known throughout the community. In fact, since there was a small number of African Americans in the community, many of the African Americans there were related to Frank. Due to everyone knowing Frank and his family or being related to him, he did not have room to get into trouble because his mother would soon learn of any problems. Since everyone in the community knew his family, he felt like a hometown superstar, which made him want to do better, stay out of trouble, and make it out of his community. Frank attended the same school district from kindergarten until high school, with the same group of friends and students. The school district did not have many African American teachers. In fact, they had only one in the elementary school. Frank also had two older brothers who attended the same schools that he did, so his mother was very familiar with the school system. His graduating class had 46 students in it, and they all knew each other and were pretty close.

Elementary Experiences. The elementary school that Frank attended was in a “good” neighborhood and was surrounded by a few houses. Frank’s elementary school was in the center
of the town. The district high school was next to the elementary school. Although the school was in a good neighborhood, the elementary school was still a very old and small building. The upkeep of Frank’s elementary school was “great for the age that it was.” The school had two hallways—one hallway housed the fourth and fifth grades, while the other hallway housed all the other grades.

Mathematics for Frank in elementary school was very simple. The concepts and ideas that were being taught came naturally to him. In kindergarten, Frank enjoyed learning about adding and subtracting. Throughout elementary Frank remained engaged in math because it came easy to him. Frank’s elementary had all White math teachers. One of his teachers incorporated fun games and activities for him and his classmates to learn adding and subtracting, which allowed for the classroom environments to be engaging for all students. In fourth and fifth grades, Frank began switching classes with other teachers. In elementary school, Frank enjoyed doing more hands-on activities and group work in class.

**Middle School Experiences.** Frank’s middle school was down the road from the high school and elementary school. It was considered to be on the outside of town. Like the elementary school, the middle school was in a very “nice” (affluent) neighborhood. The school was close to a gas station and the highway. The middle school was the newest building in the district. Frank’s middle school had two gyms in it. Frank and his classmates considered one gym the old gym and the other one the new gym. The new gym was built about 10 years ago, while the older gym was built when the school was built. Something noteworthy about the middle school building was that it was made up of an elementary school and a middle school. While the school was in one building, they were separated, middle school was on one side, and upper elementary (fourth and fifth grades) was on the other side.
In middle school, Frank’s motivation to do well in mathematics and all his other core classes was through his friendships. Frank had a very good friend who came in middle school and pushed him to do well in each of his classes. Because of his friend group in middle school, Frank had no choice but to succeed in his classes because they challenged one another to continue to do better. However, it was around this time that he began not liking mathematics as much as the other subjects such as English. Similarly, his friend group did not like mathematics either, so they knew and understood that it was going to take a unified effort to ensure that each other was successful in math.

In addition to teaching mathematics in the classroom, Frank’s school also tried to engage students in learning mathematics outside of their classroom walls. Frank and his peers engaged in math bees each year where they competed against each other to see who could get the right answer. Frank and his peers were given a math problem and were asked to solve it. Each of the students prepared for this event because that was something that they always looked forward to.

**High School Experiences.** Frank’s high school building was old. People in Frank’s community always talked about how long the school had been there. In the school, some curtains had been in the same location since the school was built and the original stage was still standing. The teaching staff in the school was very small and had about 12 full-time teachers in the building. Some of the teachers in the school taught multiple subjects to ensure each of the areas was being taught.

Although middle school was when Frank began not liking math, it was not until his sophomore year of high school that he began struggling with math. During his sophomore year, Frank had to take Geometry. Frank struggled in Geometry because he didn’t fully understand
how to solve proofs. Frank could not wrap his head around how to solve a proof with
the little information that was given to him. There were so many steps that Frank had to
remember, and it just would not click with him. There were multiple times when Frank missed
one step and had to start over on a problem in Geometry. Frank was now seeing mathematics in a
new light; it was no longer easy. Instead, it had become more complex.

During Frank’s junior year, math began to become a little more complicated, and Frank
had to buckle down and study more to ensure that he was successful in the math class. In
addition, Frank was asked to take a dual credit Statistics course, with which he struggled as
well. Again, he had to study more, and he earned A’s in both of his dual credit courses. In both
the dual credit courses, he struggled not having an actual teacher teaching the content in front of
him and with the concepts that both of the courses presented. Frank had not been introduced to
many of the concepts taught in Statistics before he took the course. This was the last time that
he took a mathematics course. He did not have to take any in college because of the dual credit
courses.

Although Frank struggled through his dual credit mathematics classes, he felt very
confident when learning math. His confidence was derived from having a strong support group—
his friends. Frank and his friends knew that they had to support each other when it came to
making it through the dual-credit mathematics class. In addition, Frank’s high school
mathematics teacher, who was White, was always so proud of the work that he did in any of his
mathematics classes. She always helped Frank, including in his dual credit
mathematics courses where he struggled a little.

**Frank’s Mathematics Identity.** Frank has always considered himself to be a successful
math student throughout his K-12 experience, even though it was not his favorite subject. Frank
found confidence in mathematics through peer and teacher relationships. Even through his challenges with Geometry and Statistics, he maintained his confidence and commitment to learning the subject. His positive relationships helped him to continue to persevere through learning K-12 mathematics content. Although he persisted and was successful in high school mathematics, his connection to mathematics did not extend beyond his K-12 schooling experiences. He did not take mathematics in college.

_Nevaeh_

Nevaeh was from a town with about 10,000 people that has continued to grow since she left there for college. Neveah’s community was known for its rich history, such as the old Methodist Church where several celebrities had gotten married or the old women’s college that was present in the town. There were several different communities throughout her town. Neveah lived in a small community that was predominately African American. Although there were multiple communities, the town was small enough that it felt as if many (if not most) residents knew each other, regardless of the part of town that they lived in.

Nevaeh was raised with her mother, father, grandfather (until he passed), and her brother in that same community. Neveah would look out of her bedroom window and see the corn that her grandfather had planted around the house. The people in her community were considered family because everyone knew each other. In Neveah’s close-knit community, the people looked out for one another and made sure that everyone had what they needed. If Neveah did something wrong, the people in the community would tell her parents. Therefore, Neveah was always well behaved when she was out in the community. In her town, there is one high school, one middle school, and three elementary schools. Each elementary school fed into the middle and high school. Each of the schools was in a different area of her town so each community had a school
in it. However, the schools were not far from each other. Neveah had the opportunity to attend each of the schools in the district, and she played basketball and volleyball throughout middle and high school.

**Elementary Experiences.** Because of the makeup of her district during the time she was in elementary, Neveah attended each of the three elementary schools in her district. Neveah attended Marian Elementary first, which was close to the downtown area of her city. Marian Elementary was an older building, with the preschool and kindergarten being in portable classrooms behind the school. At the time, in Neveah’s district, Marian Elementary was the only school that housed preschool and kindergarten. Therefore, all of Neveah’s peers in preschool and kindergarten were from around the entire town. Neveah then attended Sample Elementary for first through fourth grades. Sample Elementary was in a very rural area of the small city. It was an older building and was one of the first schools to be remodeled. It was surrounded by cornfields. Lastly, for fifth and sixth grades, Neveah attended Raymond Elementary. Raymond Elementary was the old Black high school before desegregation, and the school had been renovated to be an elementary school. This school was in a predominately Black community. Neveah’s school district ensured that each of the students attended each of the elementary schools, and they fed into one another.

Neveah enjoyed Marian Elementary School because the school engaged all learners in intentional reading and learning time. Additionally, Neveah learned the basics such as how to count by 10s at Marian Elementary. For example, Neveah’s kindergarten teacher taught them mathematics by keeping up with the days of the month. Neveah and her peers had to tell the teacher that the 22nd of the month had two 10s and two 1s. Neveah’s teacher also represented this by putting two straws in the 10s cup and two straws in the 1s cup. Neveah remembered this
vividly because this was the first time she saw a teacher who looked like her—her kindergarten teacher was African American.

In first grade, Neveah's White mathematics teacher engaged her and her peers in many activities. For example, they would count and do the days of the week together. Neveah not only learned math in school that year, but she would also go home and make connections to what she had learned in school. Neveah would sit at the kitchen table and count money and coins. Her parents even had a number line at the kitchen table where Neveah could practice her math skills. The kitchen table was where she would do her schoolwork too. Neveah even participated in school-to-home mathematics initiatives such as the 100th day of school where she would bring 100 items to school to show off to her peers.

Neveah’s experiences at Sample Elementary were salient to her learning progress. Neveah had another African American female teacher during this time, Mrs. Logan. Mrs. Logan taught Neveah how to multiply. Neveah was able to use tricks that she was taught by Mrs. Logan such as using her fingers to complete and remember her 9s. Neveah would put her fourth finger down to solve $9 \times 4$, and she would see that she would get 36. Hands-on activities such as this kept Neveah and her classmates engaged while learning mathematics. That year Neveah had to memorize her multiplication to be successful in mathematics. Neveah and her peers would compete against each other in class to see who knew their multiplication tables.

After leaving Mrs. Logan’s class at Sample Elementary, Neveah began experiencing some traumatic experiences with mathematics and learning. At a young age, Neveah felt that some of her White teachers at Sample Elementary had begun trying to limit her growth and development. For example, there would be times when her teachers would teach to one demographic and leave others out such as the higher achieving students and leave out students
who did not quit understand the material. Those negative experiences left a bad taste in her mouth. Nevertheless, those bad experiences were outweighed by good experiences with another fourth-grade teacher named Miss Miller. She was very intentional with Neveah’s learning. Although Miss Miller, Neveah’s fourth-grade teacher, was White, she wanted all her students to be successful.

Arriving at Raymond Elementary was a breath of fresh air for Neveah. It was during this time that Neveah began excelling in mathematics. Neveah came to understand that it was okay to be smart, and she began seeing the benefit of learning mathematics. Neveah was a sponge when it came to learning. During this time, Neveah began pulling away from her peers academically. Neveah’s teachers, who were all White, would often pull her and a small group of other students out and allow them to do advanced work, including in mathematics. The work that she and the small group did was 2-3 weeks in advance of their peers. According to Neveah, she was just naturally good at mathematics during this time.

Middle School Experiences. Neveah’s middle school experience was noteworthy. While most students attended middle school for 3 years, Neveah only had 2 years at her middle school. This was due to the district revamping the grade configuration. When Neveah came to the middle school in seventh grade, the first group of sixth graders came as well. So, Neveah and her peers were not the only students who had to transition to the new school that year. The older building had gone through major renovations the year before to ensure that they had their cafeteria (they had been sharing with the high school years before) and had enough room for three classes of students rather than two. They even built a new hallway to make room for all the new students that were coming that year. Neveah’s middle school was located off the main road of the town. It was adjacent to the high school.
Neveah began learning pre-algebra in middle school during her seventh-grade year. She enjoyed learning mathematics and began grasping it pretty well. Mathematics was not her favorite subject going into middle school; she preferred science and language arts. Similar to how mathematics was for Neveah in elementary school, science began to become her favorite subject. Neveah would take notes and follow along with the teacher. Neveah and the seventh-grade teacher, who was White, did not have a strong relationship; instead, Neveah wanted to finish the year and move on to the next teacher because she did not like to complain about teaching styles. Neveah’s seventh-grade teacher did not make sure that everyone understood the content and would move on quickly. Although Neveah was able to comprehend the material, there were times that she had to try extra hard along with her peers because the whole class was struggling.

When Neveah’s seventh-grade mathematics teacher went on maternity leave, Neveah and her peers had a substitute teacher, who was White, that they all loved. The substitute allowed the students to stay on the content as long as they needed. The substitute told Neveah and her peers that if they needed to stay on the subject for 17 days, then that is what they would do. Neveah excelled because she was able to make a strong connection to the material. After all, the teacher was not moving quickly anymore. According to Neveah, other students in the class also excelled. She attributed this to the approach taken by the substitute. Because of the substitute teacher’s support and help, Neveah was able to take Algebra I as an eighth grader.

Although Neveah was good in mathematics in middle school and pre-algebra, it was when she began Algebra I as an eighth grader that she began to struggle in silence. Due to her good grades, Neveah was placed in the Algebra I class but was too scared to speak up if she had a question or did not understand because of her quiet and reserved nature and disposition. She
was able to learn some of the material through group work because Neveah’s teacher used that method of teaching a lot. However, when Neveah was working independently, there were often times when she did not get the material. This caused Neveah to have serval gaps in understanding the Algebra content that would later impact her.

**High School Experiences.** Neveah’s high school assignment was no surprise. As mentioned before, all the schools in her city fed into each other. She spent her 4 years at the same high school, with the same group of students from middle school. Neveah’s high school offered a vocational school that had agriculture, nursing, and other types of trade classes. The high school was newer because two smaller high schools had consolidated a few years ago to make her high school. While in high school, Neveah was involved in many activities and was an honors track student. Along with sports, Neveah participated in organizations such as Future Business Leaders Association (FBLA), National Beta Club, Health Occupations Students of America (HOSA), and Fellowship of Christian Athletes (FCA). In most of those organizations, she held officer positions, so Neveah was well-known around the school by faculty, staff, and other students.

Since Neveah was an honors student, she was placed into Geometry in her freshman year of high school. Honors Geometry was a course that Neveah struggled with. One of the reasons she struggled was because of the proofs in the class. Her experience in Geometry made her not want to come to school because it was such as challenge for her. With it being the first period, the course would ruin Neveah’s whole day and mood. Even though Neveah’s Geometry teacher, a White woman, was very passionate about the subject, there was a disconnect between Neveah and the content Neveah’s teacher would often teach the students who naturally understood Geometry and leave students like Neveah confused. Neveah’s teacher would often talk about
content that would go over her head and only the high achievers in Geometry would understand. Due to her not fully understanding all the concepts in Honors Geometry, Neveah’s teacher recommended several times that Neveah be removed from the course and go back to Algebra I. Yet, Neveah persisted and continued to work through the class, barely passing.

Algebra II was a breath of fresh air for Neveah. Although she had been removed from the honors track in math, she had the opportunity to take accelerated Algebra II, which was a step above regular Algebra II. She had a White teacher that made learning math fun and easy again. Her teacher was very organized and predictable. According to Neveah, she was able to learn from her Algebra II teacher because she knew what to expect when going to her class. The teacher gave multiple examples throughout the lesson and never deterred from that form of teaching. Neveah’s Algebra II teacher would get straight to the point of the lesson and ask her and her peers if they had any questions. If not, the teacher would move on to the next part of the lesson. Finally, Neveah’s Algebra II teacher would give them assignments to work on that were like what she went over in class. Having a positive experience in Algebra II really boosted Neveah’s confidence in mathematics again after being removed from the honors track.

In her junior year, Neveah had the opportunity to take College Algebra at a community college because she did well in Algebra II. She took this course for college credit, and it was a little challenging for her to learn the material since she was a first-generation college student. Much of the first couple of weeks were easy for Neveah because it was material that she had seen in Algebra II. However, after that, the material quickly took off and became a little more rigorous. Neveah had to study hard and by this time she was not afraid to ask for help if she did not know the material. Although tough, the College Algebra course exposed Neveah to what to expect from college once she graduated from high school.
Neveah’s last year of school was spent in AP Statistics. Neveah loved Statistics because it merged her love for writing and English with mathematics. Neveah was a writer at heart, so when she was able to write about mathematics rather than only solving a problem, she loved that. Although Neveah made a 2 on her AP Statistics test, she took pride in that course because she was one of the higher performers. Some of her peers in that course scored a 1 on the final assessment.

**Nevaeh’s Mathematics Identity.** Nevaeh’s mathematics identity and sense of belonging were conflicted and changing. She was confident and successful in mathematics during her elementary years and made connections to the mathematics content outside of school. Yet, she experienced a disconnect with mathematics later on in her K-12 education trajectory. She enjoyed the procedural and concrete parts of mathematics but did not enjoy the abstract nature of mathematics. Nevertheless, she persevered through difficult mathematics courses such as College Algebra. Unlike some of the other participants, Neveah’s connection was stronger with Statistics than other mathematics content. In this way, her mathematics identity shifted over time and in different contexts.

**Rosa**

Rosa was from a rural town in the southern part of the country. Rosa’s town population was currently declining and had less than 15,000 people. Rosa grew up in a town that was economically divided. In Rosa’s town, there were some “good” (well-off) neighborhoods, but there were also some “rough” (impoverished) ones. In some communities, there were broken-down houses, open lots where houses used to be, and areas of poverty. Rosa lived in an area that was considered middle class with her mom and stepdad. In other communities, there were mansions with swimming pools. Rosa grew up seeing this divide as well as the town being
filled with crime, drugs, and murder. Even though the town had this local reputation, people would come and visit because of the music festivals that it hosted. People would drive thousands of miles to hear the music from the town.

Rosa’s community did not have many food choices or places to shop; instead, residents had to drive to surrounding communities to get items such as clothing or to find nice restaurants. Additionally, many programs and initiatives that were for the children around the community had been closed. Rosa’s mom continued to keep a close eye on Rosa’s brothers and sister because of the challenges of the community. For such a small town, there were a lot of children and schools. The town had two different school districts when Rosa was in school—the county and the city.

**Elementary Experiences.** There were a few elementary schools in Rosa’s hometown. Each of the elementary schools was in a different community. However, Rosa attended two of the elementary schools in the city—Littletown Elementary and Mitchell Elementary. According to Rosa, her elementary schools had similar teaching styles (the teachers used the same teaching techniques). Both of Rosa’s schools were considered math and science schools for elementary students. In both schools, the grade levels shared materials such as books.

In elementary school, around second grade, Rosa had to learn her multiplication tables. The teacher, a White woman, would often set a timer, and Rosa and her peers would have to answer several multiplication tables before the time ran out. By doing this, Rosa and her peers were able to memorize the multiplication facts that they would need later on in math. Rosa always wanted to get her work done. She did not care about learning the content, rather she just wanted to be finished.
Rosa learned concepts such as order of operations in elementary school too, in third and fourth grades. Rosa’s teacher would give her a worksheet that allowed her to work several order of operations problems out. While working them out, the teacher would time Rosa to see how many she got correctly. Sometimes Rosa would become confused and work the problems out of order.

**Middle School Experiences.** Rosa attended her neighborhood middle school. Instead of having specialized schools, Rosa’s school district zoned students for middle school. It was based on students’ community and the street that they lived on. The middle school Rosa attended was an older building with three hallways. In Rosa’s middle school, they adopted a high school approach and switched classes; the subjects were departmentalized. Rosa and her peers had seven classes a day, which included electives and their core courses.

Rosa had the same teacher for all 3 years of middle school. Rosa’s teacher was originally from India. According to Rosa, there was a language barrier that caused the students to not be successful in learning math in the teacher’s class. There were times in middle school when Rosa and her peers would reach out to the other mathematics teacher for clarification on the tasks and assignments given in class. While in class, Rosa would try to complete her work silently while her peers complained about not being able to understand the teacher. Rosa and her classmates blame the school administration for not listening to their need to have a mathematics teacher that they could understand and connect with. Because of this, Rosa and many of her peers became disconnected during their middle school years.

**High School Experiences.** Rosa attended two different high schools—one was a ninth-grade academy, and the other one was a regular high school. The ninth-grade academy allowed the students, including Rosa, the opportunity to get used to high school before being with all the
other high school students. The ninth-grade academy was in one of the more impoverished areas of town. The school was located in the center of this community and was surrounded by apartment complex buildings. During her time at the ninth-grade academy, the school district tried something new where the students had to wear specific attire such as white button-downs and bowties. The academy building once was her old elementary school. The district just repainted it and used it as the academy. Once she finished the ninth-grade academy, she attended the county high school. The county high school was across from the community in which she was living. The county high school was surrounded by fields and had four hallways. The school building was old and there were times that Rosa and her peers went without water and heat in the building.

In high school, Rosa became a student who was not afraid to ask for help when she did not understand. One reason this occurred was that she had the same mathematics teacher for all 3 years of high school. Rosa began to become more active. Rosa would go to the board and be a group leader when the teacher (a White woman) asked her to be. Rosa’s high school mathematics teacher made the class fun and engaging, which made her and her peers eager to learn. Although Rosa was a fairly good math student, she struggled with understanding coordinate graphs. Rosa had continued to struggle with graphs since they were introduced in elementary school. In high school, she would still get confused about the negative and positive slope. In school, Rosa would be given a quiz or assignment with a graph on it, and she would fail it. She failed every quiz or assignment that had a graph.

Rosa had a White mathematics teacher in high school that prepared her for college. When she needed help or was confused in math, Rosa would seek help from her mathematics teacher. Rosa and her mathematics teacher built a bond where Rosa could reach out to her if she needed
help while in college. The teacher would help Rosa by saying you may want to fix this, or you may want to look at that. Rosa worked closely with her mathematics teacher to ensure she was learning. Because of her high school teacher, Rosa became very proficient in mathematics and often did not have to show her work for simple math problems. Not only did her math teacher push mathematical proficiency, but she also pushed confidence.

**Rosa’s Mathematics Identity.** Rosa’s sense of belonging and confidence was conflicted as a mathematics learner throughout her K-12 experience. In her early years of schooling, she enjoyed learning mathematics and the thrill of solving mathematics problems and would have been considered a “math person.” However, in her secondary years, her confidence began to shift. Even though Rosa continued to persist through her mathematics courses after elementary school, her interest and enjoyment of learning mathematics disappeared.

**Overview of the Main Themes**

Throughout the narrative interview, participants were asked a series of questions (Appendix C) where they had the opportunity to reflect on their experiences as a Black mathematics learner from a rural K-12 background. In this section, I will describe each theme and include quotes from the interviews.

**Theme #1: K-12 mathematics experiences are variable (with highs and lows) and context-dependent.**

The participants’ narratives included examples of the ups and downs of learning mathematics. There were times of confidence and success and times of struggle and frustration. For example, Apollo noted that, “most confident in math would definitely be early middle school because at that point I had mastered…I feel like I mastered the basics because of the way we kept notes in middle school.” Apollo was able to feel confident in his middle school years
because of the notes that he took in class: “In middle school…anytime that I had a question, even when I was at home, even when I was at home doing homework, I always had my composition notebook that had all the tips and tricks that she had taught” Yet, this experience of confidence and success in middle school was followed by struggles in high school in which he questioned himself as a math student: “When we had to do proofs in Calculus, this is probably one of the hardest things that I struggled with.” He went on to reminisce on this experience:

Like we’ve done so much stuff that felt like it was harder than this, but for some reason, I can’t get this, this one down. And I remember I went to her [the teacher] one day after I had failed 2 quizzes in a row over the same topic and I was like, I don’t know how to do this…like this is truly stumping me.

Like Apollo, the other participants described examples of success and struggle. Within the larger theme or success and struggle were additional subthemes related to the settings or conditions of these ups and downs.

**Subtheme 1a: Advanced mathematics coursework promoted success and confidence.**

Several of the participants’ examples connected confidence to their experiences in advanced coursework. Frank described an experience of confidence in mathematics when he was placed into dual enrollment courses:

I would say when I started taking college…courses in high school. Again, in my friend group, we always challenged each other, and we knew taking those college classes we were going to need each other. We were going to have to study with each other and make sure that we were all good on the things that we were going over, and it was college classes, so. I think they made me more confident with my math and being able to pass those classes really boosted it.
Like Frank, Neveah described confidence in relation to advanced coursework. She stated that she felt the most confident when she was, “eligible to be in Algebra 2 Accelerated, which was a step above the regular math class.” In this class, she was known for being “one of the smart kids.” She was able to answer most of the questions and her peers looked at her being someone who knew the answers. She knew then that she was good at it despite some of her previous experiences. In addition, she felt confident when she took AP Statistics. She noted that she was one of the highest scorers in that class, which allowed her to feel more confident in the work in which she was engaging.

This focus on experiences in advanced coursework was a repeated idea in each of the participants’ stories. For example, Apollo discussed the importance of being in the Distinguished Scholar program at his school, which allowed him to take rigorous coursework. Apollo noted that the Distinguished Scholar program was “extra college courses.” In those courses, he was expected to do well because he was going to college. Additionally, he noted that “my junior and senior year, I had to do Pre-Cal and Calculus,” which was part of his rigorous course of study for his prestigious program.

Darius also talked about his experiences with learning mathematics through advanced courses. Although his explanation was very minimal, he noted he was a natural-born mathematics learner and that in high school was when he “started taking like college math classes.” For example, he discussed taking Statistics through a community college, where the mathematics instructor would come to the school to teach them.

Similar to Darius, Frank also mentioned that he had taken advanced courses. Frank also took Statistics as a dual credit course. Darius stated, “Stats and stats and umm [Thinking]…in high school for college credits. So, that’s when things started to get a little more complicated, but
I still managed to come out with A’s in all those classes.” Frank, like the other participants in this study, took rigorous coursework.

Neveah also had a salient story about her taking dual credit courses while in high school. She stated:

And then my junior year, I took classes at the local community college, so I was able to take College Algebra during that…that year and get some college credit. So that was kind of a challenge. But also, I was glad to go ahead and…and have that exposure to college as well.

Through her experience, she was able to take the college mathematics course while in high school to receive credit at the community college. In addition to taking the College Algebra course her junior year, Neveah continued to take advanced courses her senior year. Neveah finished her senior year by taking AP Statistics. She continued to push herself to take other rigorous courses to ensure that it would help her in the long run.

Lastly, Rosa also pushed herself to excel in the mathematics classroom with the help of her teacher. Rosa noted, “And I had a college algebra teacher who tried to get us to learn how to do those without a calculator.” Through experiences like this, Rosa was pushed to do well in the college course so that she would be prepared when she made it to college. In this way, the experiences of taking and persisting in advanced coursework ran throughout the participants’ stories and, for some of the participants, served as sites of developing confidence.

**Subtheme 1b: Sites of struggle were often tied to specific mathematical content.**

Each of the participants had an example of a time when they struggled in mathematics. In Apollo’s case, it was Calculus and the process of creating proofs. In Frank’s case, one site of struggle was proofs in Geometry:
Doing proofs, there was just something that, I couldn’t really get cause there was so much that went along with it, and different steps going into it. And if it wasn’t, if you missed one step you had to start all over. So, it was just frustrating for me.

Darius also shared an experience of struggle within mathematics. He talked about how learning Statistics was new to him during his senior year. When asked about the most difficult experience that he had in mathematics, Darius stated, “I say my senior year of high school when learning Statistics. It was very challenging to come up with the answers.” Statistics was a math like none other he had taken because it required some word answers, responses, or educated guesses. There was even a time that Darius took a test in Statistics and did not know any of the answers, so he tried his best and just went with his instincts on the problems. He said that he felt this way because in Statistics, “it’s like you…basically, taking an educated guess. So, it was you just never knew if you were right or not, no matter what. Even if you feel like you’re doing it right or not.” Darius’s struggle with mathematics was derived from uncertainty in answers. However, Darius ended up earning a B in the course.

Neveah also had an example of struggle in her mathematics learning experience. While the prior participants’ struggle had been in upper-division courses, hers was early on in her high school career (freshman year) while taking Geometry. She noted, Honors Geometry definitely was something that had me, ooh wee, not looking forward to school at all. With it, especially with it being my first period of the day as well. It was just kind of a downer just to start the day off with that class. Despite Neveah’s struggles with Geometry, she was able to persist through the class and end up passing the course.
Similar to the other participants, Rosa had several experiences of struggle in mathematics. When asked about a topic with which she struggled in mathematics, Rosa noted graphs. She said, “I know my weakness in math has always been graphs and dealing with like the y-slope and things like that. That’s probably one of the things I struggled with the most in math.”

Rosa stated,

Monday he [the teacher] will teach one lesson because he broke his lesson down into four days and every Friday we have to take a big test. But every day we took pop quizzes and I think when we were on that lesson about like graphing and slope and stuff like that, I think I failed every last pop quiz.

Although Rosa failed the quizzes in the course, she was able to make a passing score to complete the course.

Yet, despite these struggles, the students persisted through (advanced) high school coursework. According to Frank,

Failure is a good teacher; I like to say so. No matter how many times I uhh [thinking]…struggle with it [math] or didn’t do my best, it always made me learn something different, no matter what it was, until I eventually got it.

**Theme #2: For better or worse, teacher relationships matter.**

A repeated theme in the participants’ narratives was the importance of their relationships with teachers. This theme of teacher-student relationships was reflected in both positive and negative experiences. Moreover, in the narratives, the salience of relationships appeared tied both to the rural school setting and to race.

**Subtheme 2a: Teacher connections and relationships matter more when they are longer term.**
One subtheme that emerged from the data was that the connections and relationships that are made between the student and the teacher in rural schools matter, in part because they last for more than one year. Due to the size of the schools that many of the participants attended, they talk about the importance of having a relationship or connection with the teachers in the school due to multiyear teacher placements and limited teacher turnover (with the exception of Neveah). Below I share some of the quotes from the participants about the effective teacher-to-student relationships that helped their mathematics identities develop.

Although Apollo does not explicitly mention that he had the same teachers for multiple years, he discusses the significance of building relationships with teachers in the school, even if they were not his primary teacher. Additionally, Apollo tended to already be connected to the teachers in the schools because of his family (his mother who was a teacher and his older siblings). Therefore, the teachers already knew Apollo and had a relationship with him before teaching him since the teachers in his school rarely left. Apollo noted that since his older siblings had his mathematics teacher, he was able to form a strong relationship with her as well. He said,

I needed to make sure I’m…I’m friends with this teacher that way if push comes to shove then I…I know I can ask her a question and she’ll be able to help, you know. So, I think that I did have a good relationship with that teacher, partly because of my sibling, but partly because I made a constant effort to make sure that I was on it in that class.

Due to his relationship with the teacher in the class, he wanted to be a better mathematics student, which made him enhance his mathematical identity. Because he attended a small school, Apollo was able to receive support through the connections that he had with a teacher who had been at the school for a while.
Darius had similar experiences where he was close to his teachers because of the multiyear placements and low turnover rates. Darius mentioned that he was very close to all his teachers due to the nature of the small school and staff. Darius had the same mathematics teachers throughout middle and high school. Darius noted that “the same math teacher. It was just like different grade levels on the content we were doing.” As a result, the teacher knew and understood what each of the students needed. Additionally, Darius had one mathematics teacher in high school. Darius mentioned that his high school mathematics teacher taught him Algebra 1, Geometry, and Algebra 2.

Similar to Darius, Frank discussed the salience of teacher connections in smaller schools. Frank was able to get to know his teachers and build stronger relationships because they stayed at the school and taught multiple subjects in the school. Frank mentioned that “there was never really many teachers in the school system at all. Uhh [Thinking]…I know in high school I think they were like maybe…at most 12 teachers in the school. And umm [Thinking]…some teachers taught multiple subjects.” This was the same for mathematics. Frank’s high school mathematics teacher built her students’ confidence over a period of years. Frank noted that each year, his mathematics teacher would say how “proud of me she was when it came to math, and how good I was doing the math.”

Rosa also had a positive experience based on a multiyear placement. She discussed the importance of having the same teacher as she progressed through high school. Rosa mentioned that, “I had the same math teacher most of high school. And she was she was a very engaging teacher. She always was willing to help you figure it out.” Having that same mathematics teacher allowed her to learn math in a way where the teacher understood the needs of the students.
Yet, it is important to note that the small school size and multiyear placements can also operate in a negative way when it comes to teacher-student relationships. Specifically, Rosa had a traumatic experience with a teacher that was likely made worse by the fact that she had the same teacher for three years. She discussed how she had a math teacher who was originally from another country. Rosa and her peers struggled to learn from the teacher. Rosa stated:

“They [faculty, staff, and administration] did realize how hard it was on us [the students] to learn from a foreign teacher, and when we did try to talk to someone, it was kind of like they brushed us off to like you know, your kids [shaking head]. Y’all don’t like paying attention anyway. And I feel like they could have been better.

The trauma of not being able to effectively learn was compounded by the unresponsiveness of the faculty and administrators at her school. Rosa and her friends wanted to learn the content but did not have the support. Moreover, the situation extended over multiple years.

**Subtheme 2b: Race matters when it comes to teacher-student relationships.**

As with the influence of small school size and multiyear teacher placements, the influence of race was described in both positive and negative ways by the participants with respect to their relationships with teachers. Many of the participants, with the exception of Rosa, had majority White teachers as they progressed through their rural K-12 learning experience.

As a result, when they did have an opportunity to learn from an African American teacher, their reflections on these experiences were overwhelmingly positive and meaningful. These relationships made an impact. For example, Darius mentioned that he had a kindergarten teacher that was an African American female that made a significant impact on his learning trajectory through their relationship. He mentioned that his teacher, Miss Tamika, knew his situation inside and outside of the classroom. She catered to his learning needs and
individualized his learning so that he could succeed. He mentioned that Miss Tamika “wasn't trying to be too hard on me because she knew I knew.” He coined her as one of his favorite teachers and mentioned that “I had a very close relationship with her.” This relationship is still strong to this day.

Neveah also was able to discuss the salience of having a few African American teachers in elementary school. In describing her experience with one of her African American teachers, she stated:

And she would count it out and I just really thought that that was dope and how she did that and even going to…and this is also an African American teacher too that did this, that stuck out too. So maybe that’s another reason why that’s something that stands out to me as well. And then even going to Simpson Elementary, I was, goodness, blessed and fortunate to actually have another African American teacher.

In this segment, Neveah was able to convey the importance of having teachers who look like her to help build a strong foundation in mathematics.

Similar to Apollo, Frank mentioned that he did not have any African American teachers. However, through his interview, Frank made some profound comments about the significance of African American teachers in mathematics.

I would say umm [Thinking] being from [name of city], umm [Thinking]…it being very rural we…I didn’t have many African American teachers, umm [Thinking] when it came to education, period. And, I think having one in math would probably…like say for instance, I have one for proofs, I think I could have…done better with the proofs, and umhm [Thinking] been able to understand it better with somebody that looked like me.
While the participants’ descriptions of their relationships with same-race teachers were overwhelmingly positive (although limited in number), there were also several examples of negative experiences with non-Black teachers. For example, Apollo discussed about how he navigated through his high school career as a minoritized student in a predominately White school: “Coming as a young Black man in a predominantly White area, I was always under the impression that my White teachers would not favor me, and I experienced that a few times, even in high school where it was.”

In some cases, these experiences with non-Black teachers were so negative as to reach the level of trauma. These experiences have stayed with the participants throughout their lives. For example, Apollo told a story of a time when mathematics made him cry. Apollo stated that,

I remember that was the first time I’d ever cried over math. I didn’t…I was not the crying type, especially over school, because school generally came easy to me. But I’ll never forget. That was the first time I came home one day and I was working on it and I threw my stuff and I started bawling so much because it didn’t make any sense because I checked it not only with my homework but with two of my friend’s homework and I was like, I do not know where I made my mistake, so that was probably one of the hardest that has to do with math.

In this instance, Apollo had negative feelings and feelings of sadness because he did not understand the material that he was engaging in as a mathematics learner. When asking for help from his White teacher, she told him to just slow down when completing mathematics problems. While that seemed helpful on her end, Apollo still was in distress.

Similarly, Neveah told of story of being intentionally overlooked by her White mathematics teacher when needing help.
I never took that time [to learn the math material] because I, I mean, after a while I just kind of felt like, okay, like she [the teacher] doesn’t care anyway because she seemed to be so invested with the higher achieving students in the class to which we were all in an honors class. So, we were all high achieving students, but it just kind of seemed like she intentionally left some of us on the outskirts and that just kind of, you know, left a bad taste in my mouth and kind of just even to this day.

In addition, Neveah described an experience of low expectations when she was placed in Geometry:

Freshman year was really rough with Honors Geometry and there was even a moment where she [the teacher] was recommending that I move down and basically take Algebra 1 over again, which I did not want to do because I had already taken that before. So, I didn’t want to go back and take it again. So, it was just, it was a rough time, but I mean, I suffered through it.

**Theme #3: Positive peer relationships support mathematics learning.**

Another theme that emerged from the data was how positive peer relationships support mathematics learning. Positive student-to-student (peer) relationships played a key role in ensuring that participants were held accountable for learning mathematics and with identity development. The peer relationships also aided in providing additional supports for learning mathematics other than the teacher. In this section, I described the relationships that each of the participants discussed in the interviews (except Nevaeh).

Apollo shared how his friends always provided support for him as he continued through his mathematics journey. For example, Apollo mentioned, “And I think my friends always tell me that my anxiety got a part of me, and they made me forget some of those [mathematics
problems] because the more I looked at, the more frustrated I got.” In times of need, his peers supported him to continue to do the best he could do in mathematics. Additionally, Apollo mentioned, “And even in that, just having…having the same group of friends, although had its ups and its downs. I think when the main thing is like if y’all…we stuck together.” Apollo discusses several examples of he and his classmates helping each other learn mathematics such as checking each other’s homework or coming to school early to study for a mathematics test before taking it. Through it all, he had a support system for his friends.

I asked Darius how peer-to-peer relationships impacted his learning. He mentioned this:

I would say like the relationship with my friends. We all like was close my…my class…graduating class was very close with each other, so we all make sure that we were good at what we were doing at the particular time.

He mentioned that it was because of his positive friendships that he felt confident in his mathematics ability. Those positive relationships helped propel him academically in mathematics.

Frank felt the same way that Darius and Apollo did about the importance of positive peer relationships when learning mathematics. Frank noted the following about his peers and friends in school:

We were like best friends. Still best friends to this day, and no matter what it was, we always made sure we were good at different things that we were going through, whether it was math or just life in general. We always made sure each other stayed on their toes with everything, and when we needed help with something, with a kind of math, we always helped each other and told each other because…umm [Thinking]…I learn better from my peers, so he is always there to help me with that.
His friends helped him through the mathematics class, and he was able to develop his mathematics identity through the help of positive interactions and relationships with his peers.

Rosa mentioned that her peers in her class having debates really enhanced her mathematics learning and mathematics identity. She mentioned that:

But I think that’s one thing that sticks with me the most because we will have…me and my friends will have debates. We will just put a random problem and be like solve this. I know you can’t solve that. I know you don’t remember how to solve it. But that’s I think that’s one thing that stuck with me the most.

Thus, in addition to the teacher-student relationships, peer relations were salient in the narratives of the participants. I acknowledge that it is impossible to attribute the significance of these types of relationships strictly to the rural school setting (i.e., peer relationships might have emerged as a theme for participants in other settings as well). However, the fact that the participants described attending school with the same students throughout K-12 points to the potential impact of rural school features (e.g., small school size and stability of the student population) on the experience of peer support.

Summary

This chapter provides a brief overview of the findings from the data and the participants’ backgrounds. I described each of the participants and gave a little insight into who they were. In addition, I was able to integrate some of the data into this section by focusing on the themes that emerged from the data. Those themes included variable and context-dependent experiences, strong teacher relationships, and positive peer relationships. In the next chapter, I discuss these themes and their relationship to the research questions.
CHAPTER V: DISCUSSION

Introduction

The purpose of this qualitative study was to better understand how African American/Black college students from rural K-12 educational backgrounds describe their learning mathematics experience. In this chapter, the major themes and findings that emerged from the data are discussed. Those themes were: (1) K-12 mathematics experiences are variable and context-dependent, (2) for better or worse, teacher relationships matter, and (3) positive peer relationships support mathematics learning. In addition to the major themes being discussed, this chapter provides discussions on limitations, implications of the findings, recommendations for future research, and final thoughts and conclusions.

Research Questions

My research was guided by two main questions:

1. How do Black college students from rural backgrounds describe their mathematics experiences in K-12 settings?
2. How does the rural context influence the mathematics identities of Black college students?

Discussion

As noted in Chapter II, mathematics identity has been a recent focus of research in mathematics education (Aguirre et al., 2013; Cribbs et al., 2015; Darragh, 2016; Latterell & Wilson, 2017; Wang & Goldschmidt, 2003). Within this larger body of research, scholars have paid particular attention to the mathematics identity development of African American students. The research reported in this dissertation contributes to this larger body of research (Martin 2000, 2007; McGee & Martin, 2011; Varelas et al., 2011) by focusing on the experiences and
identities of African American students in rural schools. In this section, I seek to tie the findings from my study back to the existing research.

**RQ1: How do Black college students from rural backgrounds describe their mathematics experiences in K-12 settings?**

As described in Chapter II, the existing literature on the mathematics identity of African American students describes examples of both academic success (Noble, 2011; Berry et al., 2011) and traumatic experiences (Gholson & Robinson, 2019; Davis & Martin, 2008). Many of the studies on the experiences and identity development of African American students have explicitly focused either on stories of success or stories of trauma. However, most of my participants’ mathematics trajectories (excluding Darius) presented hills (academic successes) and valleys (traumatic experiences) that impacted their learning. The trajectories described by these participants were not positive linear experiences (academic successes) or the opposite (traumatic experiences). Thus, through the data presented in the study, my participants described experiences of mathematics that included both successes and struggles (Martin, 2000). Their narratives reflected a “mixed bag” of identity-shaping experiences.

While a few of the students’ accounts of struggle focused primarily on the mathematics content (e.g., proofs in Geometry or Calculus), several of the negative experiences were tied to specific teachers. For example, one participant believed that her teacher “did not care.” In another example, Rosa struggled to learn from one of her teachers, and the administrators “brushed…off” students’ concerns about the teacher. Although the participants did not always link these negative experiences to race, there were examples in which the participants perceived race as a factor. For example, according to Apollo, “as a young Black man in a predominantly White area, I was always under the impression that my White teachers would not favor me, and I
experienced that a few times.” These negative racialized experiences are similar to those described by African American mathematics students in research by scholars such as Martin (2006) and others (Davis & Martin, 2008; Gholson & Robinson, 2019; Martin, 2019). For example, Morton (2014) noted that often African American students and other minority populations face challenges that prevent them from feeling successful and confident in the mathematics classroom. Oftentimes, this is the narrative that is told for African American students learning mathematics (Morton, 2014).

At the same time, the participants’ stories also included examples of success and confidence. Their experiences of confidence and success ranged from elementary school to high school. While the literature on mathematics education for African American students includes several examples of negative experiences, Stinson’s (2013) research highlighted African American students who were both successful and confident in learning mathematics. Through qualitative responses, Stinson was able to provide research that showed that African American students can achieve and persist in mathematics classrooms, especially when an equity and justice approach to teaching was present.

One notable feature of this group of participants was their experience of advanced mathematics courses. Nationally, African American students tend to be underenrolled in advanced high school courses, which include mathematics courses (Corra & Lovaglia, 2012; Johnson & Kritsonis, 2006). Corra and Lovaglia (2012) noted that African American high school students do not take standard high school courses because of barriers such as differential expectations, stereotype threat, and social isolation. In addition, Johnson and Kritsonis (2006) noted that African Americans are often misadvised or advised not to take advanced mathematics
classes. Moreover, at a national level, rural schools have been shown to offer fewer advanced course opportunities, due to limited funding (Tieken & Montgomery, 2021).

After reviewing the participants’ data, this trajectory of lower-level courses was not clearly reflected in the experiences of the participants. The participants in this study took several advanced mathematics courses such as Pre-Calculus, dual-credit College Algebra, Calculus, honor courses, and Statistics. Each of the participants described their experiences with these courses and how they helped prepare them for future mathematics or college. While these accounts of advanced mathematics coursework might appear out of alignment with existing literature on both rural schools and African American students, it is important to note that participants in this study do not necessarily reflect the larger experiences of rural African American students. These participants were recruited from a population of college students. As such, they would be more likely to have taken advanced coursework than the general population of rural, African American students.

In summary, the findings of my study reflect several of the themes of the existing research on the mathematics experiences of African American students. There were accounts of negative racialized experiences and other examples of success and confidence. While the pattern of ups and downs (i.e., experiences of trauma and success) were not necessarily unique to rural students, there were other elements of their narratives and identities that seem to have been significantly influenced by the fact that they attended rural schools.

RQ2: How does the rural context influence the mathematics identities of Black college students?

As described in Chapter II, one primary perspective on mathematics identity focuses on the concept of belonging (Langer-Osuna & Esmonde, 2017). With respect to mathematics
identity, belonging is a description of the learner’s connection to mathematics as a subject. Does the student view themselves as “a math person” (Langer-Osuna & Esmonde, 2017) or “good at math” (Solomon et al., 2011)? Does the student demonstrate confidence and persistence (Solomon et al., 2011)? Is the student interested in mathematics beyond its importance as a school subject (Boaler et al., 2000)? In this way, the mathematics identity of a student is characterized by either “belonging” or “distance” (Langer-Osuna & Esmonde, 2017).

The mathematics identities of the participants in my study can be described as fluid, neither consistently “fragile” nor consistently “robust” (Solomon et al., 2011). In general, the participants described early stories of belonging with respect to mathematics. In many cases, they were confident and connected to mathematics in elementary grades. However, as they continued in their K-12 trajectory, their sense of belonging diminished. There were several reasons that this occurred, such as a traumatic experiences, being disconnected from the teacher, or not understanding the content. The feeling of distance seemed to occur, for many students, in the middle school years, with feeling of disengagement and disinterest increasing during this time. This distancing in middle school is consistent with other research on mathematics identity (J. Wang & Goldschmidt, 2003).

Yet, the distancing process was not always permanent. For example, Neveah seemed to experience distancing during middle school. However, her sense of belonging seemed to strengthen at the end of high school, particularly when she took Statistics. Similarly, other students told stories of distancing, with respect to interest or connection. But, as they demonstrated persistence (in advanced courses), their confidence maintained or grew. Even if they did not see themselves as a “math person,” they continued to have confidence and perseverance.
I submit that the participants in my study demonstrated that mathematics identity is also influenced by a second type of belonging and that this belonging is tied to the rural school setting. Due to the nature of the small school environments, the participants felt as if they belonged (interpersonally) in their schools and classrooms because they had been with the same teachers and peers throughout multiple years of the K-12 experience. Rural schools tend to have teachers who can work with their students for more than one year and build relationships with them. Because of these strong relationships, students felt comfortable learning mathematics.

In addition, due to small student populations and limited student turnover, the long-term connections with peers also seemed to create a sense of (interpersonal) belonging. I argue that this interpersonal belonging strengthened students’ mathematics identity. Even when the participants’ lacked the mathematical belonging described in the existing research (i.e., they did not see themselves as a “math person”), their interpersonal belonging supported confidence and persistence. The participants understood the significance of knowing and learning mathematics. This recognition, coupled with the salient relationships that they had developed with their peers and teachers, allowed them to continue to push through mathematics, even when interest and connection decreased. In this way, the rural school setting seems to have strengthened mathematical belonging (or reduced distancing) through a mathematics identity involving interpersonal belonging.

My study not only focused on the mathematics identities of rural students but of rural African American students. And the stories of my participants reflected some similarities and differences with the existing research on the mathematics identity of African American students. As Langer-Osuna & Esmonde (2017) argue, narrative research on mathematics identity can shed light on how belonging is organized by race. Black learners (and youth) are able to share the
salience of race through storytelling (English-Clarke et al., 2012). My participants’ stories provided some insight into these processes.

As noted in Chapter II, like other research on mathematics identity (Solomon et al., 2011), McGee (2015) described mathematics identities of Black students as fragile or robust. However, her research with African American college students showed that mathematics identity development and what it means to have a fragile or robust identity can be influenced by race. In McGee’s (2015) framework, an African American student demonstrates a robust mathematical identity when the student: defines him/herself as enjoying or embracing the mathematics; demonstrates stable and clever coping strategies to racialized mathematics experiences; and is internally-focused and self-affirming regarding mathematics outcomes and success. McGee argues that students’ mathematics identities are either mostly fragile or mostly robust and shift over time and in different contexts.

As noted above, the participants in my study demonstrated this shifting in identity, sometimes feeling connection and enjoyment but also experiencing distancing (moving to more fragile). However, the participants in my study did not describe the same types of racialized coping strategies identified by McGee (2015). While they did describe racialized experiences in mathematics, particularly in some relationships with teachers, these did not seem to lead to the reactive responses associated with a fragile identity nor the “stable and clever coping strategies” that go with a robust identity.

I submit that this difference between McGee’s (2015) framework and my study could be related to the rural context. The rural setting seemed to operate as a “protective” (McGee & Pearman, 2014) factor. Through the positive influence of peer relationships and the strength of many teacher-student relationships (particularly with African American teachers), my
participants seemed to have come through racialized mathematics experiences with fewer “scars” than the students in McGee’s (2015) research. In this way, the rural setting appears to have had a significant influence on the mathematics identity of African American students. The potential role of relationships as a significant protective factor for African American students’ mathematics identity is a primary contribution of this research.

Limitations

A primary limitation of my study was the focus on college students from a single 4-year institution. While the selection of this institution allowed for a convenience sample that included rural students from different areas, the experiences of college students might differ in important ways from African American rural students who do not attend college. For example, the participants in this study likely had higher-than-average rates of enrollment in advanced mathematics. Additionally, the participants in my study had not only enrolled in college but had persisted through at least one year. If I were to do this study again, I would seek to include students currently enrolled in K-12 schools and/or rural high school completers who did not continue to a 4-year college.

Another potential limitation of the study was the fact that I did not directly gather data from the participants related to the influence of socioeconomic status. While there are some indirect hints (e.g., Apollo’s parents’ professions) in the narratives, the role of socioeconomic status was not a focus of my study. As a consequence, we do not have any insight from the study into the intersection of race, class, and rurality in the development of mathematics identity for African American students.
Implications of Findings

The findings of my study have several implications for future research and practice. However, for this section, I will explore three of them. The findings from this study further confirmed the importance of relationships in the (rural) mathematics classroom, both teacher-student and student-to-student relationships. This finding has potential implications for mathematics teacher education, as it highlights the need to prepare future mathematics teachers to focus on building relationships, not just knowledge of content. Without relationship building, students will not be so willing to learn the content. In addition, mathematics teacher educators should help future teachers focus not only on their own relationships with students but also on opportunities to build positive peer relationships in the classroom.

Another key takeaway from my study was the fact that the participants did not appear to have a linear trajectory in mathematics education. My research noted that students can experience periods, school years, or content-based successes or failures. Some students may struggle with certain areas of a subject, depending on many factors such as teaching styles, especially in mathematics. Potential implications for this finding are that preservice and current mathematics teachers must be willing to individualize students’ mathematics learning and not utilize a “one-size-fits-all approach” to instruction. Additionally, it is important for teachers to recognize that students’ trajectories are not linear. Past experiences or test scores should not be viewed in a deterministic way. By doing this, they will be able to meet students where they are and potentially break down barriers to learning mathematics.

The last finding from this study is that race holds salience in African American students’ learning experiences. Students are not able to navigate learning without acknowledging their race as part of the learning experience. Thus, future teachers and education preparation programs
need to use learning pedagogies and methods that are inclusive to all students such as culturally relevant teaching, culturally sustaining teaching, and culturally responsive teaching. Using these frameworks in teaching will allow students to include their race and other salient parts of their identity in the learning process.

**Recommendations for Future Research**

For this study, there are two major recommendations for future research. First, the salience of the rural setting appeared to emerge in various ways in the stories of my participants. For example, the participants shared several examples of being taught by the same teacher for multiple years or subjects. Due to the small size of high schools, there might be one or two math teachers. So, all students take the same teacher for multiple years. One question raised by my study involves the influence of this multiyear placement on students’ mathematics identity. In most cases, the participants in my study seemed to experience this as a positive influence. However, in at least one case, the multiyear placement was a traumatic experience. Future research might explore the prevalence of multiyear placements in rural mathematics education and their impact on mathematics identity.

Secondly, another critical finding from the research is that students do not have a linear mathematics learning experience. For example, most of the participants from the study had times when they were successful in mathematics, and other times they struggled in mathematics. Future research on mathematics identity could explore these “hills” and “valleys” in the experiences of rural African American students in greater depth.

**Final Thoughts and Conclusions**

I began this dissertation with my own story of mathematics learning in rural schools. The stories of my participants were similar to my own in several respects. They reflected on the
importance of relationships and shared many of my experiences of attending schools in a rural setting (e.g., having teachers who taught older siblings or relatives). I learned from the narratives of the participants that learning and the development of mathematics identity are not linear processes. Instead, students, including myself, have high points (maxima) and low points (minima) in learning and connection to mathematics. While students may understand specific material or content in one mathematics class, they may also struggle in other areas of mathematics. The needs of the learner can differ from class, year, and subject. I also learned from this study that, although there are some commonalities in the experiences of learners who have similar backgrounds, no two students’ experiences were the same. While many aspects of their stories resonated with my own, each narrative was unique.
References


https://doi.org/10.1111/cdev.12363


https://www.rand.org/pubs/technical_reports/TR718.html


https://doi.org/10.20429/nyarj.2018.030102


rural settings; Methodological issues, international perspectives and practical solutions
(pp. 7-25). Routledge.

instruction: Analysis of the rhetorical literature. *Journal of Research in Rural
Education, 20*(7), 1-16.

https://www.researchgate.net/publication/26405305_Prescriptions_for_Rural_Mathematics_Instruction_Analysis_of_the_Rhetorical_Literature

 School climate as a link between high school Black males’ math identity and

https://doi.org/10.1177/0013124520931453

underrepresented in advanced mathematics courses. *National Journal for Publishing and
Mentoring Doctoral Student Research, 3*(1), 1-8.


research*. SAGE.


https://doi.org/10.5951/jresematheduc.48.3.0237

Cai (Ed.), *Compendium for research in mathematics education* (pp. 637-648). The
National Council of Teachers of Mathematics, Inc.


https://doi.org/10.12697/eha.2016.4.1.02b

https://doi.org/10.5951/jresematheduc.46.5.0599


https://doi.org/10.1007/s10964-019-01115-x

https://doi.org/10.1177/0042085912447516


APPENDIX A: Recruitment Material

Recruitment Email Example

Greetings! My name is Austin Ferrell, and I am a doctoral student at the University of Memphis, working on completing my dissertation research. For my dissertation, I am seeking to learn about the mathematics experiences (both positive and negative) of African American students from rural schools.

I am looking for recent African American/Black high school graduates, who attended a rural school, from kindergarten to high school, to participate in my study. You must be between the ages of 18 and 23, and currently not be one of my academic advisees or in the Call Me MISTER® program. I ask that you meet with me one to two times over the next few months, for about an hour to two hours, each meeting. The focus will be on your experiences in mathematics.

As the researcher, I will work with you to ensure that the interview is as convenient as possible for you. Interviews can be conducted in person or via Zoom, whichever makes you feel the most comfortable. If you are interested, please send an email to aferrell@memphis.edu.

Thank you so much for your consideration and have a great day.

Best,

Austin

The University of Memphis Institutional Review Board has reviewed and approved me to conduct this research involving human subjects under the protocol PRO-FY2024-174.
APPENDIX B: Informed Consent Form

Title
PRO-FY2024-174: Narratives of African American rural students' experiences in mathematics

Researcher(s)
Austin Ferrell, The University of Memphis

Researchers Contact Information
270-804-5196, aferrell@memphis.edu

You are being asked to participate in a research study. The box below highlights key information for you to consider when deciding if you want to participate. More detailed information is provided below the box. Please ask the researcher(s) any questions about the study before you make your decision. If you volunteer, you will be one of about six people to do so.

Key Information for You to Consider

Voluntary Consent: You are being asked to volunteer for a research study. It is up to you whether you choose to participate or not. There will be no penalty or loss of benefit to which you are otherwise entitled if you choose not to participate or discontinue participation.

Purpose: The purpose of this research is to explore how African American students, from rural schools, learn mathematics.

Duration: It is expected that your participation will last 1-2 hours.

Procedures and Activities: You will be asked to participate in an audio-recorded interview.

Risk: Some of the foreseeable risks or discomforts of your participation include emotional distress related to discussing personal experiences associated with participating in a research study.

Benefits: Participating has no known direct benefits to you.

Possible Contribution: Through your contributions, the researcher may share the findings with rural schools and mathematics teachers as a way to enhance their teaching practices for rural African American students learning mathematics.

Alternatives: Participation is voluntary, and the only alternative is to not participate.

Who is conducting this research?

Austin Ferrell, of the University of Memphis, Department of Instruction and Curriculum Leadership is in charge of the study. He is being guided by Dr. Celia Anderson. There may be other research team members assisting during the study.

Why is this research being done?

The purpose is to explore how African American students, from rural schools, learn mathematics. You are being invited to participate because you meet the following specific criteria: (1) identify as African American and (2) attended a rural school from kindergarten to high school graduation.

How long will I be in this research?

The research will be conducted at the University of Memphis, in the Department of Instruction and Curriculum Leadership. It should take about 1-2 hours of your time.
What happens if I agree to participate in this Research?

If you agree you will be asked to participate in a 1-2 hour audio-recorded interview and a 1-2 hour audio-recorded follow-up interview (if needed) in a location of your choice. In the interview, you will be asked a series of questions that are related to your experience as a mathematics student in a rural K-12 school system. As a participant, you can skip any question that makes you feel uncomfortable and they can stop at any time. If you would like, the results from the research study will be available in the form of a dissertation, to you once all of its contents have been approved.

What happens to the information collected for this research?

Information collected for this research will be used to better understand how mathematics education in rural schools is potentially different than in other settings. Your name will not be in any publications (published reports, conference presentations, etc.). The researcher will publish the results from the study in their dissertation. However, the researcher will keep your name and other identifying information confidential.

How will my privacy and data confidentiality be protected?

We promise to protect your privacy and the security of your personal information as best we can. However, you need to know about some limits to this promise. Measures we will take include:
- Conducting interviews in a location in which you feel comfortable.
- Storing the data on a password-protected database where only the researcher and the researcher’s dissertation chair have access.
- After a year, the data will be destroyed from the database

Individuals and organization that monitor this research may be permitted access to inspect the research records. This monitoring may include access to your private information. These individual and organization include:
- Institutional Review Board

Research team members are required to report the following if a team member suspects child abuse or neglect, or suicidal thoughts. TN Laws may require this suspicion be reported. In such case, the research team may be obligated to breach confidentiality and may be required to disclose personal information.

What are the risks if I participate in this research?

You may experience emotional distress related to discussing personal experiences associated with participating in a research study.

What are the benefits of participating in this research?

Participating has no known direct benefits to you. We do believe that this study will help the researcher gain a better understanding of how rural African Americans learn mathematics. Furthermore, the researcher may share the findings with rural schools and mathematics teachers as a way to enhance their teaching practices for rural African American students learning mathematics.

What other choices do I have besides participating in this research?
If you do not want to be in the study, there are no other choices except not to take part in the study.

What if I want to stop participating in this research?

It is up to you to decide whether you want to volunteer for this study. It is also ok to decide to end your participation at any time. There is no penalty or loss of benefits to which you are otherwise entitled if you decide to withdraw your participation. Your decision about participating will not affect your relationship with the researcher(s) or the University of Memphis.

Will it cost me money to take part in this research?

There are no costs associated with participation in this research study.

Will I receive any compensation for participating in this research?

You will not be compensated for taking part in this research.

Who can answer my questions about this research?

Before you decide to volunteer for this study, please ask any questions that might come to mind. Later, if you have questions, suggestions, concerns, or complaints about the study, you can contact the investigator, Austin Ferrell at aferrell@memphis.edu or Dr. Celia Anderson at croussea@memphis.edu. If you have any questions about your rights as a volunteer in this research, contact the Institutional Review Board staff at the University of Memphis at 901-678-2705 or email irb@memphis.edu. We will give you a signed copy of this consent to take with you.

Focus Research Questions:

Below is a list of questions that you will asked during the interview.

1. When asked by other to tell them about yourself, what do you normally say?
2. How would you describe yourself?
3. How would you describe your community?
4. What kind of elementary school did you attend? Middle school? High school? Can you describe it?
5. What is your earliest memory of math in school?
6. What kind of mathematics student were/are you? In elementary? Middle school? High school?
7. When you experienced a topic in mathematics that was challenging to learn, how did you learn the content?
8. Tell me about a person or event in your K-12 experiences that really influenced how you felt about yourself as a math student.
9. In what ways did you feel that you were represented in the mathematics curriculum and material?
10. How could your K-12 math experiences have been better, do you think?

STATEMENT OF CONSENT

I have had the opportunity to consider the information in this document. I have asked any questions needed for me to decide about my participation. I understand that I can ask additional questions through the study.

By signing below, I volunteer to participate in this research. I understand that I am not waiving any legal rights. I have been given a copy of this consent document. I understand that if my ability to consent for myself changes, my legal representative or I may be asked to consent again prior to my continued participation.

As described above, you will be audio recorded while performing the activities described above. The audio records will be used for playback and coding only. Initial the space below if you consent to the use of audio recording as described.

_____ I agree to the use of audio record.

Name of Adult Participant    Signature of Adult Participant    Date

Researcher Signature (To be completed at the time of Informed Consent)

I have explained the research to the participant and answered all of his/her questions. I believe that he/she understand the information described in this consent and freely consent to participate.

Name of Research Team Member    Signature of Research Team Member    Date
APPENDIX C: Interview Protocol

Semi-Structured Interview Protocol

Introduction: Thank you so much for taking the time out to speak with me today. I am conducting a study to understand how African American/Black college students, who have a rural K-12 school experience, learned math. I will be using a narrative interview to collect data for this study. More specifically, this research will focus on how ruralness played a part in the way in which rural African American/Black students constructed their mathematics identity.

[Let the participant know that I will start recording].

1. Tell me a little bit about where you grew up when you were younger.
   a. During elementary, middle school, and high school years (if they are different communities).
2. How would you describe your community?
   a. What does it look like?
   b. What is it known for?
3. What kind of elementary school did you attend? Middle school? High school? Can you describe it?
   a. What did you like about your school?
4. What is your earliest memory of math in school?
5. What kind of mathematics student were/are you? In elementary? Middle school? High school?
   a. Can you tell me why you described yourself as this type of mathematics student?
   b. When did you feel the most confident in math? Why?
   c. Could you provide me with examples of when you have struggled with math?
6. What’s the hardest situation you’ve been in in a math class?
   a. How did you eventually learn the content?
7. Tell me about a person or event in your K-12 experiences that really influenced how you felt about yourself as a math student.
   a. How do you think it influenced who you are today?
   b. How did it make you feel?
   c. How did it impact you learning mathematics?
   d. Your mathematics trajectory?
8. Are there any math lessons from K-12 that resonate with you today?
   a. If so, why?
   b. If no, why not?
9. How could your K-12 math experiences have been better, do you think?
10. What else about your experiences of math growing up do you think might be important for me to know?