

# Mathematics Identity Among Rural African American Students: A Narrative Study

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This study explored the mathematics experiences and identities of five African American college students who attended rural K–12 schools in the southern United States. Using narrative inquiry and thematic analysis, the research examined how rurality shaped students' perceptions of mathematics learning and their sense of themselves as mathematics learners. Findings revealed three central themes: (a) K–12 mathematics experiences were variable and context-dependent, with advanced coursework fostering confidence while specific content areas posed persistent struggles; (b) teacher relationships strongly influenced mathematics identity, with long-term and race-conscious connections proving especially meaningful; and (c) supportive peer networks enhanced persistence and engagement in mathematics. These findings highlight the complexity of mathematics identity development in rural contexts and underscore the importance of culturally responsive teaching, relationship-building, and equitable access to advanced coursework in rural schools. Implications for practice and future research in rural mathematics education are discussed.

**Keywords:** rural education, African American students, mathematics identity, narrative inquiry, teacher-student relationships

Rural education represents a significant portion of the U.S. schooling landscape, serving nearly half of the nation's districts and over one third of all schools. Yet, despite this prevalence, rural education remains consistently underrepresented in educational research (Thier et al., 2021). The limited attention given to rural schooling obscures the unique challenges and assets that shape the experiences of students growing up in these communities. Within this broad neglect, even less attention has been paid to mathematics education in rural contexts. Mathematics is often described as a gatekeeper subject, influencing whether students can access advanced academic pathways, enroll in higher education, and pursue careers in STEM fields (Cribbs et al., 2015). For African American students, mathematics learning is often further complicated by racialized experiences that shape how they are perceived and how they come to view themselves as mathematics learners (Martin, 2007; McGee, 2015).

Urban contexts, while important, cannot fully represent the educational realities of African American students in rural communities. Rural schools often face distinctive challenges such as chronic underfunding, difficulty attracting and retaining highly qualified teachers, and limited access to advanced coursework (Tieken & Montgomery, 2021). At the same time, rural communities are often characterized by long-standing social ties, stability, and multigenerational connections between families and schools. For African American students, navigating mathematics in these contexts can mean simultaneously benefiting from

close-knit relationships and facing structural inequities linked to both race and geography. These layered experiences have received limited scholarly attention, leaving important questions unanswered about how mathematics identity develops in rural contexts.

## Mathematics Identity and Race

The construct of mathematics identity has become a central framework for understanding how students engage with mathematics and persist in mathematical learning (Darragh, 2016). Identity, in this sense, refers to how students see themselves and are seen by others as “doers of mathematics” (Aguirre et al., 2013, p. 5). Mathematics identity encompasses perceptions of ability, belonging, confidence, and the value placed on mathematics. Importantly, research has shown that mathematics identity is not formed in isolation but is shaped by social interactions with teachers, peers, and family members, as well as by broader cultural narratives about who is and is not good at math (Boaler et al., 2000; Solomon et al., 2011).

For African American students, race is inseparable from mathematics identity. Martin (2007, 2019) and others have shown that mathematics classrooms are not race-neutral spaces; rather, they can reproduce inequities, stereotypes, and deficit-based assumptions that undermine African American students’ sense of belonging in mathematics. McGee (2015) described African American students’ identities as fragile or robust depending on how they navigated racialized experiences in mathematics. Some students developed resilience and persistence despite marginalization, while others internalized deficit narratives that hindered their mathematical engagement. While this growing body of literature has deepened understanding of race and mathematics identity, its urban emphasis overlooks how these dynamics may play out differently in rural settings (Azano et al., 2023; Biddle & Azano, 2016).

## The Rural Context

Rural schools often have smaller student populations, higher rates of poverty, and fewer financial resources compared to suburban and urban counterparts (Mathis, 2003). Students in rural schools are less likely to have access to Advanced Placement courses, dual-credit options, or specialized mathematics instruction (Tieken & Montgomery, 2021). Teacher shortages can lead to instructors teaching outside their areas of expertise, which may further impact students’ mathematics opportunities. At the same time, rural schools are embedded within communities where teachers, parents, and students often know one another personally across generations. Teachers who remain in the same district for decades may develop deep, sustained relationships with families, which can be both supportive and constraining (Fregoso, 2024; Howley & Howley, 2014).

For African American students in rural schools, the rural context intersects with racial identity in complex ways. Some students may feel heightened visibility as one of only a few African Americans in advanced mathematics courses, while others may experience stronger affirmation from teachers who share

long-term relational histories with their families. Peer networks may provide essential encouragement and accountability for students navigating advanced coursework with limited institutional supports. Yet, despite these dynamics, the research literature has not fully explored how African American students describe their mathematics learning in rural settings or how rurality shapes their mathematics identities.

## Purpose of the Study

This study sought to address this gap by exploring how African American students from rural backgrounds narrate their mathematics experiences and identities. Using narrative inquiry, the research centered the voices of five African American college students who reflected on their K–12 mathematics trajectories. Their stories illuminate how rural schooling contexts, teacher relationships, and peer networks shaped both their academic performance and their sense of self in mathematics. By examining these narratives, this study contributes to a fuller understanding of mathematics identity formation in rural schools.

## Significance

This study makes several contributions to the literature on both mathematics identity and rural education. First, it situates mathematics identity research within the rural context, expanding a field that has largely concentrated on urban education. Second, it amplifies the voices of African American students in rural schools, who are often marginalized in both research and practice. Third, the findings provide practical insights for teachers, administrators, and policymakers working to improve equity in rural mathematics education. By highlighting the central role of teacher relationships and peer support, the study underscores the importance of culturally responsive pedagogy, mentoring, and intentional structures that foster belonging.

Beyond its scholarly contributions, this research has direct implications for practice. Teachers in rural schools may be uniquely positioned to influence mathematics identity due to the long-term nature of their relationships with students. Culturally responsive practices and affirming teacher-student relationships can counteract negative stereotypes and foster persistence in mathematics. Similarly, creating opportunities for positive peer collaboration can help sustain students' confidence and motivation. At the policy level, addressing disparities in access to advanced coursework is critical to ensuring that African American students in rural schools are not systematically denied opportunities to develop strong mathematics identities.

## Research Questions

This study was guided by the following research questions:

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

## Literature Review

### Rural Education

Rural education has long been a neglected area of scholarly inquiry, despite the fact that nearly half of U.S. school districts and over one third of schools are located in rural areas (Thier et al., 2021). Rurality is more than a geographic label; it encompasses cultural, social, and economic dimensions that shape students' opportunities and constraints (Howley & Howley, 2014). The diversity of rural communities complicates efforts to define "rural," with federal and state agencies employing varied classifications based on population, proximity to urban centers, and economic activity (Coladarci, 2007). This variability highlights the importance of situating research in context, as rurality can mean different things in different regions of the country.

#### *Defining Rurality*

Researchers have wrestled with how best to define rurality, and these definitional debates have important consequences for policy and practice. For example, a school deemed rural under one classification system may not be considered rural under another. These inconsistencies can obscure the realities faced by schools that contend with limited funding, high poverty, and geographic isolation. At the same time, rural schools often occupy central roles within their communities, serving not only as educational institutions but also as social and cultural hubs (Biddle & Azano, 2016).

#### *Challenges Facing Rural Schools*

Although rural schools are often celebrated for their close-knit communities, they also face persistent challenges that affect both teaching and learning. Chronic underfunding, difficulties in recruiting and retaining highly qualified teachers, and limited access to advanced coursework are among the most pressing issues (Tieken & Montgomery, 2021). Smaller student populations make it difficult to justify the expense of specialized mathematics courses such as calculus or statistics, thereby restricting students' academic opportunities. Limited professional development and reduced access to technology further constrain instructional quality and innovation. These challenges collectively shape the academic trajectories of rural students and restrict their postsecondary opportunities.

The COVID-19 pandemic further illuminated the inequities that have long characterized rural education. Rural schools faced amplified challenges related to broadband access, technology integration, and teacher retention, all of which directly affected students' academic engagement. A study by Graves et al. (2021) found that 1 in 6 rural students came from areas with poor broadband coverage, leading to significant disparities in access to remote learning opportunities. Similarly, Kormos and Wisdom (2021) highlighted that rural educators often rely on personal trial and error to integrate technology, due to budgetary constraints and limited student internet access at home. These challenges are compounded by teacher shortages, with rural districts facing unique difficulties in attracting and retaining qualified educators, which further impacts student learning outcomes (Fregoso, 2024). Incorporating these perspectives strengthens the call for research that considers how place-based inequities interact with racialized experiences in shaping mathematics learning.

### *African American Students in Rural Schools*

The experiences of African American students in rural schools remain particularly underexplored. Rural communities are often imagined as predominantly White, yet they are increasingly diverse, with African American, Latinx, and immigrant populations contributing to growing demographic complexity (Tieken & Montgomery, 2021). For African American students, rural schooling presents both opportunities and inequities. On one hand, the small size of rural schools can create strong, long-lasting relationships between teachers and students. On the other, structural inequities—such as underrepresentation in advanced mathematics courses and exposure to novice teachers—limit access to rigorous learning opportunities (Logan & Burdick-Will, 2017). The dual realities of support and inequity highlight the need to study African American students' experiences in rural mathematics classrooms.

Within rural mathematics education, access to rigorous coursework remains one of the most persistent equity challenges (Biddle & Azano, 2016; Showalter et al., 2019). Limited funding and teacher shortages often restrict course offerings, leaving African American students with fewer opportunities to pursue advanced mathematics. These inequities not only affect academic preparation but also influence how students perceive themselves as mathematics learners. When advanced coursework is unavailable, students may internalize structural barriers as personal limitations, reinforcing deficit-based narratives about ability. Addressing these disparities requires not only structural reform but also intentional relational and pedagogical practices that affirm students' mathematical potential within constrained contexts.

### Mathematics Identity

In addition to understanding rural schooling, it is important to consider the role of mathematics identity in shaping students' academic pathways. Mathematics identity has become a central construct in educational research because it captures not only what students know but also how they see themselves in relation to mathematics (Aguirre et al., 2013; Darragh, 2016). Identity provides a lens for examining why some students persist in mathematics while others disengage, regardless of their demonstrated ability.

### *Defining Mathematics Identity*

Mathematics identity refers to how students perceive themselves and how they are recognized by others as mathematics learners. It involves perceptions of ability, feelings of belonging, motivation to persist, and recognition from teachers and peers (Solomon et al., 2011). Unlike test scores or grades, identity is not a static measure but rather a dynamic story that evolves over time (Sfard & Prusak, 2005). Students' identities can be strengthened by experiences of success and affirmation or undermined by exclusion and failure.

### *Components of Mathematics Identity*

Research has identified several key dimensions of mathematics identity that influence persistence. These include students' self-perceptions of competence, their sense of belonging in mathematics spaces, and the degree to which they feel recognized by others as capable (Aguirre et al., 2013; Latterell & Wilson, 2017). Students who view themselves positively in these domains are more likely to pursue advanced coursework and STEM careers, whereas students with fragile or negative identities often avoid mathematics whenever possible (Latterell & Wilson, 2017). Identity therefore operates both as an outcome of prior experiences and as a predictor of future engagement.

### *Narrative Approaches*

One powerful way to understand mathematics identity is through narrative approaches. Narrative theory views identity as the stories that students tell about themselves, shaped by both internal reflections and external interactions (Langer-Osuna & Esmonde, 2017; Sfard & Prusak, 2005). These narratives are constructed over time and reflect experiences of success, belonging, marginalization, or exclusion. Teachers and peers play central roles in these narratives, as recognition and affirmation can strengthen mathematics identity, while stereotypes or neglect can erode it (Cribbs et al., 2015). Because mathematics is often framed as objective and meritocratic, students may internalize struggles as reflections of personal inadequacy rather than responses to inequitable systems.

### *Rural Considerations in Mathematics Identity*

Despite the importance of mathematics identity, little research has considered how geography shapes its development. Rural students' mathematics identities may be influenced by the structural limitations of small schools, including fewer advanced courses, reduced access to enrichment, and long-term relationships with the same teachers. These dynamics can either support or constrain identity formation. For African American students in rural schools, identity development is further complicated by racialized experiences, making it essential to examine how rurality and race intersect to shape mathematics identity (Aguirre et al., 2013; Biddle & Azano, 2016).

## Race in Mathematics Education

While rurality and identity are both critical factors, race adds another layer of complexity to mathematics education. For African American students, mathematics identity cannot be separated from racial identity. Classrooms are not neutral spaces; they are shaped by racialized interactions, expectations, and power dynamics (Martin, 2007, 2019). Understanding the role of race in mathematics education is therefore essential for examining African American students' experiences in rural schools.

### *Race and Identity in Mathematics*

Research has consistently shown that African American students experience mathematics through a racialized lens. Martin (2007) documented how students often framed their experiences explicitly as Black learners in mathematics, highlighting the inseparability of race and mathematics identity. These dynamics contribute to fragile identities, in which students may persist in mathematics but remain vulnerable to racial stereotypes and deficit-based assumptions (McGee, 2015).

### *Experiences of Marginalization*

African American students frequently encounter stereotype threat, lowered expectations, and deficit-based perspectives in mathematics classrooms (Gholson & Robinson, 2019). These experiences can undermine confidence, erode persistence, and lead students to internalize negative narratives about themselves as mathematics learners. For some, mathematics becomes a site of struggle and alienation rather than empowerment. At the same time, students also develop strategies of resistance, demonstrating resilience and persistence despite systemic inequities (McGee & Pearman, 2014). The tension between fragility and resilience underscores the complexity of mathematics identity for African American students.

### *Protective Factors and Teacher Relationships*

Despite challenges, research also identifies protective factors that support robust mathematics identities. Berry et al. (2011) found that relational support, recognition of ability, and affirmation of racial identity were particularly influential for African American boys. Teachers who engage in culturally responsive pedagogy and maintain long-term, supportive relationships can counteract negative stereotypes and affirm students' identities (Fregoso, 2024; Gay, 2018). Similarly, peer networks provide encouragement and accountability, reinforcing persistence in mathematics. These protective factors underscore the relational nature of mathematics identity and point to potential strategies for supporting African American students in rural schools.

Additionally, culturally responsive teaching provides a promising approach for strengthening mathematics identity among African American students, particularly in rural settings where racial diversity among teachers is limited. Rooted in the work of Ladson-Billings (1995), Gay (2018), and Gholson and Robinson (2019), culturally responsive pedagogy emphasizes the integration of students' lived experiences, cultural knowledge, and community contexts into instruction. When teachers use culturally

affirming examples, communicate high expectations, and demonstrate care, they validate students' intellectual capacity and counter deficit-oriented assumptions. In rural mathematics classrooms, such practices can be transformative, helping students see themselves not as outsiders to mathematics but as capable participants whose experiences and perspectives matter.

### *Rural Contexts and Race*

While race and mathematics identity have been studied extensively in urban settings, far less is known about how these dynamics unfold in rural schools. Rural African American students may face unique challenges, such as being one of few students of color in advanced classes, which heightens visibility and social pressures. At the same time, the smaller size of rural schools often leads to more sustained relationships with teachers, which can either support or constrain identity development. Limited resources and fewer advanced opportunities compound these challenges, creating a distinct rural-racial context that warrants focused investigation (Azano et al., 2023; Fregoso, 2024).

### *Intersectionality and Mathematics Identity*

Understanding mathematics identity among African American students in rural contexts requires attention to the ways race, geography, and opportunity intersect. Drawing from intersectionality theory (Collins, 2019; Crenshaw, 1991), this study recognizes that students' experiences are shaped by overlapping systems of power that influence access, belonging, and recognition. Intersectionality provides a lens for examining how African American students navigate mathematics spaces that are simultaneously racialized and geographically marginalized. Rather than viewing race and rurality as separate or additive factors, this framework emphasizes their interaction—how being both African American and rural uniquely shapes students' mathematics trajectories. Through this perspective, mathematics identity is understood not only as a reflection of individual experience but also as a product of broader structural and cultural forces that define who is seen as capable, who is supported, and who is excluded within mathematics learning spaces.

### *Summary*

This literature review underscores the importance of examining mathematics identity at the intersection of rural education and race. Rural schools face structural challenges that restrict access to rigorous mathematics coursework, yet they also provide opportunities for strong relational ties. Mathematics identity research highlights the importance of belonging, recognizing, and persisting, but has rarely considered rural contexts. Race shapes African American students' experiences in mathematics in rural settings too, yet most research has focused on urban schools.

The current study addresses these gaps by centering the narratives of African American students who attended rural schools. By examining their stories, this research illuminates how rurality and race

intersect to influence mathematics identity and provides insights into how educators and policymakers can better support equity in rural mathematics education.

## Methodology

### Research Design

This study employed a qualitative narrative inquiry design to explore how African American students from rural schools described their mathematics learning and identities. Narrative inquiry was chosen because it provides a lens for understanding how people construct meaning through stories (Clandinin & Connelly, 2000). Identities are not static traits but evolving narratives that individuals tell about themselves in relation to others and to broader contexts (Clandinin & Connelly, 2000; Sfard & Prusak, 2005). By eliciting and analyzing participants' stories, the study sought to illuminate how mathematics learning experiences, teacher and peer relationships, and the rural context shaped students' identities as mathematics learners.

The emphasis in narrative inquiry is not on generalization but on the richness of lived experience. This approach acknowledges that individual stories are situated within broader social, cultural, and institutional contexts. For African American students from rural schools, mathematics identity cannot be disentangled from the racialized and resource-constrained settings in which their schooling occurred. Narrative inquiry provided an avenue to capture the complexity of these intersections and to highlight participants' voices in their own terms.

### Participants

Five African American college students (undergraduate and graduate) at a public university in the southern United States participated in this study. All had attended and completed their K–12 education in rural school districts as defined by state and federal criteria, in the southwestern part of the United States. Purposive sampling guided participant selection to ensure relevance to the research questions. Criteria for inclusion were that participants identified as African American, completed their K–12 schooling in a rural context, and were willing to participate in multiple interviews that explored mathematics experiences.

The group consisted of both men and women and represented a variety of majors in the social sciences, education, and health professions. None were mathematics majors, but all had successfully completed required college-level mathematics coursework. Their retrospective accounts allowed for a holistic look at how mathematics identity was formed and reshaped over time, from early schooling through college entry. Each participant brought unique perspectives. Some described strong affinity with mathematics at particular points, while others narrated persistent struggles. Collectively, their voices illustrated both the diversity and commonality of African American students' experiences in rural mathematics education. Table 1 includes information about the participants, including their selected pseudonym, age, gender, classification, and general location of hometown.

**Table 1***Participants' Demographics*

| Participant's name | Age | Location/Area where participant grew up | Gender | College classification [credits wise] |
|--------------------|-----|-----------------------------------------|--------|---------------------------------------|
| Apollo             | 21  | Northwestern part of State A            | M      | Senior                                |
| Darius             | 19  | Northwestern part of State A            | M      | Sophomore                             |
| Frank              | 20  | Northwestern part of State A            | M      | Junior                                |
| Nevaeh             | 23  | Southwestern part of State B            | F      | First semester graduate student       |
| Rosa               | 22  | Northwestern part of State C            | F      | Senior                                |

### Data Collection

Data collection occurred over the course of a semester and consisted of semi-structured interviews conducted in two to three sessions with each participant. Each interview lasted approximately 60 to 90 minutes. The semi-structured protocol allowed consistency across participants while leaving room for individual storytelling and follow-up. Guiding questions focused on key areas, including memorable classroom experiences, encounters with specific mathematics content, relationships with teachers and peers, and reflections on how participants came to see themselves in relation to mathematics.

The first interview typically invited participants to recount their earliest memories of mathematics learning in elementary school and to trace their experiences through middle and high school. The second interview explored relationships and identity more explicitly, including moments of affirmation or discouragement, access to advanced coursework, and the role of race in shaping experiences.

All interviews were audio-recorded with participants' consent and transcribed verbatim. Field notes captured contextual details and the researcher's observations. This iterative process of multiple interviews was consistent with narrative inquiry's emphasis on building trust and co-constructing meaning between researcher and participant.

### Data Analysis

Analysis proceeded through several iterative stages, drawing on narrative and thematic approaches (Riessman, 2007). Each transcript was read multiple times to identify significant moments, storylines, and turning points that revealed how participants made sense of their mathematics experiences. Following Riessman's (2007) framework, the researcher attended to both the what and the how of each story—the content of participants' experiences and the narrative forms through which they expressed identity. Each participant's account was then crafted into a narrative portrait, organized chronologically to highlight key shifts in confidence, belonging, and recognition. These portraits served as analytic cases that

preserved the integrity of each story before engaging in cross-case thematic analysis. The cross-case synthesis identified recurring themes while also capturing tensions and contradictions that reflected the complexity of mathematics identity formation. This process ensured that the analysis honored participants' voices while revealing the broader social and cultural patterns shaping their experiences.

### Trustworthiness

Establishing trustworthiness was an important component of the study. Several strategies were used to enhance credibility, dependability, and confirmability (Lincoln & Guba, 1985). Multiple interviews with each participant allowed for prolonged engagement, providing depth and the opportunity to confirm or clarify interpretations. Member checking was conducted by sharing narrative summaries with participants and inviting feedback on accuracy and resonance. This step ensured that interpretations remained grounded in participants' perspectives.

An audit trail was maintained throughout the study, documenting analytic decisions, coding processes, and evolving themes. This transparency provided a record of how findings emerged from the data. Peer debriefing with colleagues familiar with narrative inquiry offered additional perspectives, challenging assumptions and strengthening the robustness of interpretations. Finally, reflexive journaling was used to record the researcher's insights, questions, and positional reflections across the data collection and analysis process. Collectively, these strategies enhanced the study's rigor and trustworthiness.

### Researcher Positionality

As the researcher, I acknowledge that my positionality influenced both the conduct of the study and its interpretations. I am an African American educator who grew up in a rural community and pursued advanced study in mathematics education. This background created points of connection that facilitated rapport and trust with participants, who often expressed appreciation for being understood by someone with similar experiences. At the same time, my proximity to the topic required deliberate reflexivity to avoid conflating my story with those of participants.

To address this, I engaged in ongoing reflection through journaling and peer dialogue, critically examining how my assumptions and experiences shaped the questions I asked and the interpretations I made. Narrative inquiry emphasizes relational engagement, and I sought to balance that relational stance with a commitment to honoring participants' unique voices. Recognizing that all narratives are co-constructed between researcher and participant, I worked to make visible the interpretive nature of this inquiry while foregrounding participants' perspectives.

### Summary

This study's methodology reflects its central aim: to understand how African American students from rural schools make sense of their mathematics learning and identities. Narrative inquiry provided a framework for eliciting and analyzing participants' stories in ways that highlight both individual experiences

and broader structural contexts. The combination of purposive sampling, iterative interviews, narrative analysis, and reflexive practices supported a rigorous and trustworthy account. By foregrounding participants' voices, the methodology created space to examine how rurality and race intersect to shape mathematics identity, an area rarely addressed in the literature on either mathematics education or rural schooling.

## Findings

Analysis of the five participants' stories revealed three overarching themes that illuminate how rural African American students experienced mathematics and constructed their mathematics identities. These themes were: (a) variability in mathematics experiences across K–12 schooling, (b) the central role of teacher relationships, and (c) the importance of peer support for persistence. Within each theme, participants' narratives illustrate how rurality and race shaped both opportunities and constraints.

### Variability in Mathematics Experiences

Participants described mathematics experiences that varied widely across grade levels, teachers, and content areas. Some spoke of early confidence and success, while others recounted repeated struggles that undermined their sense of belonging in mathematics. This variability often hinged on the type of instruction they received and the opportunities available within their rural schools.

Apollo recalled his early schooling with enthusiasm:

In elementary school I was always the first one to finish the math problems. Teachers would call me up to show the class how I did it, and that made me feel like I was good at math. But by middle school, it started to change. We didn't have as many resources, and sometimes the teacher just read straight from the book. That's when I started to lose confidence.

Apollo's story illustrates how early experiences of recognition can foster strong mathematics identities, but also how limited instructional practices in later grades can weaken that confidence. His narrative highlights the fragility of mathematics identity when instructional quality is inconsistent.

Other participants described variability tied to specific mathematical content. Frank explained: "I loved algebra. It made sense to me, like a puzzle. But geometry was something else. The teacher was good, but the subject just didn't click. After that, I started telling myself, maybe I'm not really a math person." Frank's reflection underscores how subject matter differences can influence identity development. His narrative also shows how students internalize struggles with particular content areas as reflections of their overall ability, a common dynamic in mathematics education.

The variability of participants' experiences was compounded by structural limitations in rural schools. Several noted the lack of advanced coursework, which curtailed opportunities to challenge themselves. Nevaeh explained:

We didn't have calculus at my school. If you wanted to take it, you had to do it online, and hardly anyone did because it was too hard without a teacher. So even though I liked math, I never got to push myself the way students in bigger schools probably did.

Nevaeh's account reflects the structural inequities of rural schooling, where advanced opportunities are often unavailable or accessible only through less supportive formats. Her story highlights how rurality shapes mathematics identity by limiting the extent to which students can explore and strengthen their abilities.

Rosa offered yet another dimension of variability. She recalled the difficulty of maintaining confidence in the face of discouraging experiences:

There were times I felt like math just wasn't for me. I'd try my best, but teachers didn't always see that. I remember one year I stayed after class almost every day to get help, but it felt like no matter what I did, I couldn't change how they saw me—as the one who struggled.

Rosa's narrative stands out for her persistence. Despite feeling unseen and sometimes underestimated, she continued to seek help and practice independently. Her experience underscores the resilience that many African American students must develop to persist in mathematics when recognition and support are inconsistent.

Together, these narratives demonstrate that mathematics experiences for rural African American students are neither uniformly positive nor uniformly negative. Instead, they are highly variable, shaped by instructional quality, subject matter, and the structural limitations of rural schools.

### The Central Role of Teacher Relationships

Across all participants, teacher relationships emerged as a defining influence on mathematics identity. Teachers were remembered not only for the content they taught but also for the ways they affirmed or discouraged students. Long-term relationships, which were common in small rural schools, amplified the influence of teachers on students' mathematics trajectories.

For some participants, teachers served as powerful sources of encouragement. Darius spoke about his high school mathematics teacher:

She was the only Black teacher I ever had, and she taught me for three years straight. She would tell me, "You can do this. Don't let anyone tell you different." She knew me, not just as a student, but as a person. That made me believe I belonged in math spaces, even when the work was hard.

Darius's narrative illustrates how representation and sustained support can strengthen mathematics identity. His teacher's recognition of both his academic and personal identity provided affirmation that counteracted stereotypes and self-doubt.

Other participants, however, described teacher relationships that undermined their confidence. Apollo reflected on one such experience in high school: "I had a teacher who never really called on me, even when I knew the answer. It was like she didn't see me. After a while, I stopped raising my hand. I figured, what's the point?" This account demonstrates how lack of recognition can erode students' sense

of competence and belonging. For Apollo, the absence of affirmation became internalized as invisibility, shaping his identity as someone excluded from mathematics participation.

Rosa also recalled how teacher interactions influenced her persistence. Although some teachers offered encouragement, others failed to recognize her efforts: “One teacher told me maybe math just wasn’t my subject. That hurt because I worked so hard. But I didn’t stop. I just stopped asking for help and tried to figure things out on my own.” Rosa’s story highlights how discouraging teacher feedback can have long-term effects, but also how resilience can emerge from those same moments of marginalization.

Long-term relationships with teachers, a hallmark of rural schooling, could therefore be either beneficial or detrimental. When positive, they provided stability, affirmation, and a sense of belonging. When negative, they reinforced feelings of inadequacy and exclusion over multiple years. The rural context thus magnified the influence of teachers on mathematics identity.

### The Importance of Peer Support

In addition to teachers, peers played a critical role in shaping participants’ mathematics identities. Supportive peer networks offered encouragement, accountability, and a sense of solidarity, particularly in contexts where students faced challenges.

Nevaeh described how working with peers helped her persist:

In high school I had a group of friends who were all in the same math class. We would study together, help each other out, and laugh when we got it wrong. It made math feel less scary. Even if I didn’t always get it, I knew I wasn’t alone.

Her story highlights the protective role of peer support in mitigating anxiety and promoting persistence. Mathematics became less isolating when shared within a supportive community.

Frank also emphasized the role of peers but noted how peer networks could be complicated by issues of race and representation: “In my advanced classes, I was usually the only Black student. My friends weren’t in those classes, so I didn’t have that same support system. It felt lonely, like I had to prove myself all the time.” Frank’s narrative points to the intersection of rurality and race in shaping peer dynamics. In small, predominantly White schools, African American students in advanced classes often found themselves isolated, without peers who shared their racial identity. This isolation heightened the pressure of representation and reduced the buffering effect of peer support.

Peer networks thus functioned as both sources of resilience and sites of vulnerability. When present, they provided encouragement and collective persistence. When absent, particularly in advanced mathematics contexts, their absence amplified feelings of isolation and fragility.

### Summary of Findings

The findings reveal that mathematics identity for African American students from rural schools was shaped by a combination of variability in instructional experiences, the influence of teacher relationships, and the role of peer support networks. Participants’ stories show how rural schooling provided both

opportunities and constraints. While small schools fostered long-term relationships, these relationships could either affirm or erode mathematics identity. Peer support provided resilience, but racial isolation in advanced classes left some students vulnerable. Structural inequities, such as limited access to advanced coursework, further constrained opportunities to strengthen mathematics identity.

These narratives underscore the complexity of mathematics identity development in rural contexts. Rather than presenting a single, uniform experience, they highlight the ways that race, rurality, and relationships intersect to shape the mathematics trajectories of African American students.

## Discussion

The narratives of Apollo, Darius, Frank, Naveah, and Rosa provide an important window into how African American students from rural communities construct mathematics identities in the context of both opportunity and constraint. Their stories complicate simplistic portrayals of rural education by revealing variability in experiences, the weight of teacher-student relationships, and the role of peer support networks. The discussion that follows situates these findings within the literature on rural schooling, mathematics identity, and race in mathematics education, before turning to implications for practice, policy, and future research. Collectively, these narratives reveal how race, rurality, and identity operate not as separate forces but as intersecting systems that shape students' mathematics experiences and opportunities to belong.

### Variability in Rural Mathematics Experiences

One of the clearest findings from this study is the unevenness of participants' mathematics experiences across grade levels, content areas, and classroom contexts. For Apollo, early confidence gave way to discouragement as instruction shifted toward rote textbook use and disengagement. For Rosa, persistent effort in the face of discouragement exemplified resilience, which is a form of agency that allowed her to persist despite inequitable treatment. Her story parallels research that shows how African American students develop complex strategies to resist marginalization and maintain self-belief (McGee, 2015). Naveah's experience of being denied access to calculus due to structural limitations highlights how rural schooling can restrict opportunities for advanced coursework. At the same time, the experiences of Frank and Darius show that student outcomes in mathematics can vary. Darius maintained success throughout high school, while Frank faced a significant barrier in Geometry.

These stories echo existing research documenting curricular disparities between rural and non-rural schools (Showalter et al., 2019). Limited course offerings, reliance on online classes, and high teacher turnover often create fragmented learning experiences. For African American students, such variability is not just academic but identity-shaping. Success in one area can be overshadowed by struggles in another, leading students to adopt self-conceptions such as "not a math person" even when their performance demonstrates otherwise. The variability observed in this study underscores the importance of considering how rural schooling structures interact with identity development in mathematics.

## The Centrality of Teacher Relationships

Participants consistently described teacher relationships as pivotal to their mathematics identities. Darius's story of affirmation from a Black teacher demonstrates how long-term, caring relationships can counteract stereotype threat and strengthen persistence. Conversely, Apollo and Frank's accounts of invisibility and discouragement show how lack of recognition can have lasting negative effects.

This finding aligns with prior scholarship emphasizing the relational dimensions of teaching (Martin, 2009). Mathematics is often framed as a neutral subject governed by rules and procedures, yet the participants' narratives make clear that relationships with teachers significantly influenced whether they saw themselves as capable mathematics learners. In rural schools, where students often have the same teacher across multiple years, these relationships are magnified. A teacher who provides affirmation across 3 consecutive years may profoundly shape a student's identity, while a teacher who dismisses or overlooks a student may reinforce feelings of inadequacy that persist long after high school.

The presence or absence of racially representative teachers also emerged as meaningful. Darius's positive experience with the only Black teacher he encountered highlights the power of representation in mathematics identity formation. For African American students in predominantly White rural schools, the racial identity of teachers can signal whether mathematics spaces are inclusive and affirming.

## The Role of Peer Networks

Peer support was another critical factor in participants' persistence with mathematics. Nevaeh described study groups as a way to buffer anxiety and provide collective resilience, while Frank highlighted the isolation of being the only African American student in advanced classes. These contrasting experiences illustrate both the potential and limitations of peer networks in rural mathematics education.

Peer influence has long been recognized as important in identity development (Nasir, 2011). For students in rural contexts, where class sizes are small and peer groups are tightly knit, the presence of supportive peers can transform mathematics from an isolating subject into a communal one. However, when African American students are racially isolated in advanced tracks, the absence of peers who share their background can amplify the burden of representation and erode confidence. This study extends prior research by showing how peer networks in rural schools are shaped not only by academic ability but also by race and representation.

## Limitations

This study, while rich in depth and context, was limited in scope. The five participants represent a specific region of the southern United States, and their stories may not capture the full range of rural African American students' experiences nationwide. Narrative inquiry prioritizes meaning over generalizability, and participants' retrospective accounts rely on memory and self-interpretation, which, while valuable, are inherently subjective. Future research might expand this work through longitudinal designs or comparative

studies across rural, suburban, and urban contexts to further illuminate how place and race intersect in mathematics identity development.

## Implications

The findings point to several actionable implications for rural educators and school leaders. First, teachers must be intentional in affirming African American students' mathematical competence. Small gestures, such as calling on students regularly, providing detailed feedback, and acknowledging effort, can have disproportionate effects in rural contexts where relationships are magnified. Teacher preparation and professional development should therefore emphasize culturally responsive pedagogy and relational teaching practices that validate students' identities alongside their mathematical learning.

Second, schools should work to expand access to advanced mathematics coursework. Where in-person offerings are not feasible due to enrollment or staffing, schools must ensure that online courses are accompanied by structured support, such as on-site facilitators, tutoring, or peer study groups. Without these supports, online courses risk becoming another form of inequity for rural students.

Third, schools should create intentional peer support structures for African American students, particularly those in advanced mathematics tracks. This might include study groups, mentoring programs, or affinity spaces where students can share experiences and strategies. Such structures can counteract isolation and foster persistence in challenging coursework.

Fourth, rural districts should prioritize recruiting and retaining teachers of color, especially in mathematics. Representation matters for African American students, not only for role modeling but also for fostering inclusive classroom climates. While recruitment challenges in rural areas are well-documented, creative partnerships with teacher preparation programs, loan forgiveness initiatives, and "grow your own" programs may help address this need.

## Implications for Policy

At the policy level, addressing disparities in rural mathematics education requires investments that go beyond infrastructure. Funding formulas should account for the additional costs of offering advanced coursework in small schools, whether through shared services, distance learning with support, or partnerships with local colleges. State-level policies should also incentivize schools to provide equitable access to rigorous mathematics courses, ensuring that rural students are not disadvantaged by geography.

Policymakers should also recognize the dual challenges faced by African American students in rural schools, who experience both racial marginalization and rural under-resourcing. Equity initiatives must therefore be tailored to address the intersection of race and rurality, rather than treating these as separate categories.

Recent policy trends reflect growing attention to rural equity, including broadband expansion, virtual learning support, and teacher retention initiatives (Azano et al., 2023; Xu, 2024). However, policy must

move beyond infrastructure to address human capital and relational dimensions of rural schooling (Yu et al., 2024). The COVID-19 pandemic made visible the compounded challenges of technological access and instructional support in rural mathematics education (Reimer & Hill, 2022). Equitable policy reform should ensure that African American students in rural areas not only gain access to advanced coursework but also encounter teachers who are culturally responsive, well-prepared, and sustained through long-term professional support. Investments that merge digital equity with human connection will be essential for advancing mathematics identity and achievement in rural schools.

### Implications for Future Research

This study adds to a growing body of literature that highlights the experiences of African American students in rural contexts, a population often overlooked in educational research. Future research should build on these findings in several ways. First, longitudinal studies could trace how mathematics identities develop across time, from elementary school through college, capturing both continuity and change. Second, comparative studies across rural, suburban, and urban contexts could further illuminate the unique contributions of rurality to mathematics identity formation. Third, intervention studies are needed to examine the effectiveness of practices such as peer study groups, culturally responsive pedagogy, and teacher recruitment initiatives in improving outcomes for African American rural students.

## Conclusion

This study examined the mathematics identities of five African American students—Apollo, Darius, Frank, Naveah, and Rosa—who were educated in rural schools. Through narrative inquiry, their stories revealed the complexity of mathematics learning in contexts shaped by race, rurality, and structural inequities. Rather than presenting a uniform picture of struggle or success, the participants' narratives illustrated variability across grade levels and content areas, the profound influence of teacher-student relationships, and the importance of peer networks for persistence.

At the center of these narratives was the role of recognition. When teachers affirmed students' efforts, adapted instruction, and cultivated caring relationships, students described themselves as capable and resilient mathematics learners. Conversely, when teachers ignored or dismissed them, students internalized invisibility and doubt. In small rural schools, where students often encounter the same teachers repeatedly, the impact of these relationships was amplified. Similarly, peers provided both protection and vulnerability: study groups and friendships offered solidarity, while racial isolation in advanced courses heightened pressure and eroded belonging.

These findings contribute to the broader literature by highlighting how mathematics identity is shaped not only by individual ability or motivation but by the intersection of race and rural schooling. For African American students, structural limitations such as limited course offerings intersect with social

dynamics that either affirm or undermine their identities. Understanding this intersection is critical for creating equitable mathematics opportunities in rural contexts.

The implications for educators and policymakers are clear. Rural schools must expand access to rigorous coursework, strengthen teacher-student relationships, cultivate peer support structures, and recruit and retain more teachers of color. Policy initiatives must also account for the compounded challenges of race and rurality, ensuring that African American students are not doubly marginalized.

Ultimately, the narratives of Apollo, Darius, Frank, Naveah, and Rosa remind us that mathematics education is not just about content mastery but about identity, belonging, and recognition. Creating rural mathematics classrooms where African American students are fully seen, supported, and challenged is both a matter of equity and a prerequisite for unlocking their full potential.

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