



**Proceedings for the 50th Annual Meeting
of the
Research Council on Mathematics Learning**

Celebrating 50 years of Research on Mathematics Learning

Reflecting on the Past, Refracting into the Future



March 2 – 4, 2023
Las Vegas, Nevada

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For citation of articles in the Proceedings:

Authors. (2023). Article title. In Cobbs, G. and Kombe, D. (Eds.). *Proceedings of the 50th Annual Meeting of the Research Council on Mathematics Learning*.

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Publication Acceptance Rate:

Accepted 10 manuscripts out of 21 submissions. Acceptance Rate of 48% (last year 41%)

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RCML History

The Research Council on Mathematics Learning, formerly The Research Council for Diagnostic and Prescriptive Mathematics, grew from a seed planted at a 1974 national conference held at Kent State University. A need for an informational sharing structure in diagnostic, prescriptive, and remedial mathematics was identified by James W. Heddens. A group of invited professional educators convened to explore, discuss, and exchange ideas especially in regard to pupils having difficulty in learning mathematics. It was noted that there was considerable fragmentation and repetition of effort in research on learning deficiencies at all levels of student mathematical development. The discussions centered on how individuals could pool their talents, resources, and research efforts to help develop a body of knowledge. The intent was for teams of researchers to work together in collaborative research focused on solving student difficulties encountered in learning mathematics.

Specific areas identified were:

1. Synthesize innovative approaches.
2. Create insightful diagnostic instruments.
3. Create diagnostic techniques.
4. Develop new and interesting materials.
5. Examine research reporting strategies.

As a professional organization, the **Research Council on Mathematics Learning (RCML)** may be thought of as a vehicle to be used by its membership to accomplish specific goals. There is opportunity for everyone to actively participate in **RCML**. Indeed, such participation is mandatory if **RCML** is to continue to provide a forum for exploration, examination, and professional growth for mathematics educators at all levels.

The Founding Members of the Council are those individuals that presented papers at one of the first three National Remedial Mathematics Conferences held at Kent State University in 1974, 1975, and 1976.

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DECONSTRUCTING BLACK PRESERVICE ELEMENTARY TEACHERS ENTERING IDENTITIES & VISIONS

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In this paper, we present findings of the entering mathematics identities and visions of high-quality mathematics teaching of Black freshman undergraduate preservice elementary teachers. Evidence suggests that race and racialized experiences impacted both their MIs and their vision for mathematics teaching, highlighting the need to attend to these constructs as we support the preparation of Black teachers who can flourish in their humanity and brilliance.

Introduction

Research has progressed to more clearly understand teachers' mathematics identities (MI) and visions of mathematics teaching (VMT) (e.g. Boaler & Greeno, 2000; Munter, 2017); however, this work often does not take into account the ways race or racialized experiences play a role in preservice teachers' MI and VMT. Others have described the ways mathematics learning experiences can be forms of racialized trauma (e.g. Matthews, 2018), and how mathematics education might be conceptualized to rehumanize Black students (e.g. Joseph et al., 2019). Separately, these studies have built an important knowledge base and generate additional empirical questions. In this paper, we share findings from a qualitative analysis of interviews with Black undergraduate first-year students who have declared elementary education as their major to answer the research question: *How and in what ways have K-12 mathematics learning experiences influenced the MIs and VMT of preservice Black elementary teachers?*

Background

We have a rich body of evidence of instructional characteristics, pedagogies, and practices that can support mathematics learners. These practices include relating mathematics to local contexts (e.g. Ladson-Billings, 1995), developing sociomathematical norms and authority (e.g. Boaler &

Staples, 2008), and positioning students as agentic and competent (e.g. Battey, 2013). Other scholars have explored ways to reconceptualize and humanize Black students' experiences with mathematics (e.g. Joseph et al., 2019) and develop clearer conceptions of Black pedagogical excellence (Acosta et al., 2018). While this evidence shows actionable progress, there still exists a stark lack of high-quality mathematics learning opportunities for Black students; with one study of 191 high school classrooms finding that only 13% of Black students engage with mathematics in classrooms that can be characterized as “high quality” (Wilson et al, 2019).

Prior to *Brown vs. Board of Education*, roughly 35-50% of teachers in America were Black. Currently, only about 7% of teachers are Black (Lee, 2019) – a sobering statistic for Black preservice teachers as they prepare to enter the teaching workforce. Many programs are engaged in work to change these statistics to reclaim Black teachers' rightful roles as aspirational figures and advocates for Black learners, and Minority Serving Institutions play a key role in this work - disproportionately preparing teachers of color (Gasman, et al., 2017). We extend these efforts by exploring how we might create a mathematics education program that acknowledges, honors, and builds from these histories to support the preparation of Black teachers who flourish.

Mathematics Identity

In our work, we draw upon Martin's (2009) definition of MI as the “dispositions and deeply held beliefs that individuals develop about their ability to participate and perform effectively in mathematics contexts and to use mathematics to change the conditions of their lives” (p. 136). This way of describing identity brings into focus different aspects of mathematics teaching and learning, and together can serve as an analytical tool to better understand the ways mathematics learning experiences shape the entering and evolving MIs of Black preservice teachers. Math education researchers have explored K-16 teachers' and students' MIs in many ways. For example, Gresalfi &

Cobb (2011) explored teachers' mathematics teaching identities as they participated in professional development focused on high-quality teaching, while Black and colleagues (2010) explored the relationship between undergraduate students' MIs and their professional career goals, concluding that further research should explore how the power of mathematics can support students in managing their evolving MIs.

Vision of Mathematics Teaching

A person's VMT is not simply a compilation of static beliefs or teaching philosophy. Rather, it is a set of concrete notions about what mathematics teaching should be that shifts with past and present experiences, knowledge, and context and becomes more layered and sophisticated over time. Seeking to explore shifts in teacher's VMT, Munter (2014) tracked their articulations of their VMT and their alignment toward research-based descriptions of high-quality mathematics teaching. Munter characterized teacher's VMT across three dimensions: the role of the teacher, the role of classroom discourse, and the role of mathematics tasks in supporting student learning. Researchers have used these dimensions in studies focused on prospective teachers (Walkowiak, Lee, & Whitehead, 2015), practicing teachers (e.g. Wilhelm, 2014); and mathematics leaders (Jackson et al., 2015) and have found that teachers with a VMT more closely aligned with high-quality teaching tend to enact instruction more closely aligned their VMT, select more rigorous mathematics tasks, and have greater content knowledge for teaching mathematics.

These studies provide robust evidence relating teachers' visions and enactments of mathematics teaching, however, Munter (2014) acknowledged that they lacked attention to ensuring mathematics learning spaces are spaces where students feel they belong and where their race, gender, or other identities are affirmed. He called for additional research exploring the relationship between his

conceptualization of vision for mathematics teaching and one that also attends to “culturally ambitious practices aimed at critical consciousness” (p. 619).

Methods

This study is a part of a multiyear study investigating ways to construct a Black liberatory mathematics education that cultivates the flourishing, humanity, and brilliance of Black preservice teachers (Martin, 2018). Focused on undergraduate elementary education student’s mathematics experiences, it explores their entering and evolving MIs and VMT as they progress through their teacher preparation program and redesign efforts to support their learning.

Phase one of the study, which we report here, explores the entering MIs and VMT of students attending a large Historically Black College and University (HBCU) in the southeastern United States. Students were recruited using a convenience sample from a course for entering freshmen who declared elementary education as their major. Of the 21 students who met the criteria, 15 chose to participate in a one-hour semi-structured interview during the Fall 2020 semester, receiving \$20 for their participation. 14 of the 15 participants identified as female and one identified as male.

Questions related to *MI* focused on: (1) K-12 mathematics concepts participants found helpful, useful, or difficult; (2) K-12 factors that may have contributed to the ways they think or feel about, relate to, or engage with mathematics; (3) their problem-solving strategies; (4) and whether they felt their race or racialized experiences played a role in their MI. Questions related to *VMT* focused on: what (1) teachers and (2) students should be doing and (3) what kinds of tasks students engaged with in high-quality mathematics classrooms; (4) how their vision has been shaped by prior learning experiences; and (4) whether race plays a role in their VMT.

After all interviews were recorded and transcribed, we used qualitative analysis software and open coding (Corbin & Strauss, 1990) to capture common themes across participants interviews

related to mathematics, identity, and vision. Next, we developed a codebook using these themes and coded each interview, reaching 89% - 100% agreement across coders at the individual code level (Table 1). Finally, because we were interested in using these findings for the design of future experiences for students, we looked for patterns related to students' MI and VMT that aligned with and diverged from practices of high-quality mathematics teaching and learning.

Findings

Shown below in Table 1 are the number of instances and percentage of total instances coded across all 15 interviews, listed in descending order. As context, across participants, interviews had an average of 35 codes and a median of 32 codes per participant.

Table 1
Number of Codes and Percentage of Total Codes

Mathematics			Identity			Vision		
Math Content	59	11%	Feelings	48	9%	Teachers	45	9%
Relevance	38	7%	Teachers	44	8%	Students	32	6%
Math Tasks	17	3%	Understanding	44	8%	Race	14	3%
Math Tools	14	3%	Performance	24	5%			
			Problem Solving	22	4%			
			Race	21	4%			

We organize our summary of these findings into two categories: mathematics identity and vision of mathematics teaching. For each category, we first share noticeable patterns that emerged from the data related to traditional ways of describing them and then highlight findings that particularly make salient racialized moments that impacted participants' MI and VMT.

Mathematics Identity: *Teachers, Tasks, and Relevance*

Participants noted many instructional practices that their K-12 teachers used to support their learning, aligned with high-quality instruction, and were positive contributions to their MI. These practices included the use of relevant tasks, providing clear explanations, sharing multiple

approaches, asking questions that explored their thinking, and providing individual support.

However, two quotes from participants summarize well the challenges Black students often face in mathematics learning spaces. First, in describing their experience with mathematics teachers, one participant stated, *“I want to learn by someone who actually wants to teach me”*, which aligned with others who had mathematics teachers who were *“strict”*, *“unforgiving”*, *“mean”*, *“yelling”*, and said things such as, *“oh well if you don’t get it [math]”*. Second, in describing the relevance of the mathematics they experienced, one participant stated, *“all of it is necessary, but then again none of it is necessary.”* This statement aligned with others who shared their experiences engaging with mathematics tasks that were *“long drawn-out problems”* or *“textbook teaching”* that was *“not useful beyond basic math”* or *“only useful to know more math”*.

Mathematics Identity: Problem Solving, Understanding, and Feelings

From the perspective of alignment with the knowledge, skills, and dispositions of high-quality mathematics teaching, participants overwhelmingly indicated a deep desire to learn, understand, and use mathematics – both as a learner and teacher. They stated that solving mathematics problems helped them develop a *“connection to math”* that *“made them feel good and smart”*, and that they desired to see and explore visual representations and different approaches to mathematics. They also stated that they wanted to understand mathematics to *“help others”* and to *“know where my [future math] students will go.”* Common themes that negatively contributed to their MI were classrooms that focused on performance and perfectionism - leading to feelings such as, *“everyone else knows it”* and the stress of the *“additive”* nature and speed of learning concepts. These feelings led students to modify their problem-solving strategies to focus on *“following steps,”* using formulas, or *“reversing through a problem.”* Lastly, there was a common theme of needing to *“prove people wrong”* when engaging in mathematics with others.

Mathematics Identity: *Racialized Experiences*

Two themes emerged related to the ways race played a role in their MI. For some, they vaguely indicated that race did not play a role or that they were unaware of it, with statements such as, *“I don't really think race played a part in it. Math is math, like no matter what race you are, either you get it, or you don't.”* For others, they stated that race did not play a role in their MI because, *“I learned in a diverse school”* and, *“maybe it might have had an impact, but I probably just didn't notice.”* Conversely, others noted the power of Black representation with statements such as, *“I've only had one Black math teacher...with her I just felt comfortable.”* While others had explicit descriptions of the ways that race impacted their MI. Related to teachers' beliefs and practices, participants made statements such as: *“we are at a disadvantage on how well our teachers think we can do...maybe if I was in a different person's shoes then maybe the teacher would try to build on what skills I have more”* and *“I did not feel comfortable asking questions and it was hard to find teachers who did not just talk down to us.”* Finally, related to teachers, we share the following quotes to demonstrate the impact some White teachers had on Black preservice teachers' MI.

Honestly, I think she was racist. We were the only two Black kids in the class and she was a White lady. I feel like she wasn't as supportive because we were Black. She wouldn't help us, would just give us the answer instead of teaching us. When we did ask questions, she would have an attitude. It's like why ask the question. I'm aggravated because I'm a student trying to learn and get into college. I need a good grade.

The black kids in regular math classes and the white kids in the honors. It was like they just knew how to do it because they actually taught and helped them. Teachers just gave us stuff saying, “here's stuff, do it, learn it, if you don't oh well.” I felt like my teachers didn't care enough to show us how to do it. Why should I care enough to like learn it.

Vision of Mathematics Teaching: The Role of the Teacher, Tasks, and Students

When articulating their VMT, participants provided vague descriptions of what teachers should be doing, with statements focused on teachers being “*supportive so that students aren’t confused,*” ensuring that students “*feel comfortable*” or safe to ask questions, and a general focus on student compliance over mathematical understanding when students were engaging with mathematics. When describing their vision for what students should be doing, they noted that they should be collaborating, but again focused on compliance or following the teachers’ expectations, with comments focused on ensuring that students “*do their work.*” However, there were three instances stating that students should be engaged in “*exploration*” and “*discovery.*”

Vision of Mathematics Teaching: Racialized Visions

Two themes emerged related to the ways participants articulated whether race played a role in their VMT. First, like MI, some participants shared what might be described as a colorblind or equality approach to their vision with statements such as: “*I would teach all the kids the same*” and “*I feel like when we... put race into a classroom, it hurts the child more than it hurts the teacher...just straight down the middle.*” Second, and most prevalent were quotes from participants relating their VMT to representation and past mathematics learning experiences.

I want students to see “that it’s possible that they have a Black, educated teacher that understands what they’re talking about. [I] should’ve seen more people that look like me doing things like this.”

“Just because you had a bad experience in high school with your math teachers because of the way you were Black ... doesn’t mean you gotta let somebody else go through that same situation.”

“I’ve seen teachers put Black students on one side and Whites on another... I was in it. The teacher was like “any questions.” I’ve left not knowing before and get home still confused. My goal is to never let a child leave confused. I don’t care how long it takes.”

“I feel like I’m going to have to work a little harder than everybody else. It’s my duty and my responsibility to reach out to young black students ... because the world is going to knock them down and make them feel like their bad students or whatever else they have to say about us. But I feel like you know it’s really going to be my job to build them back up and know ensure them that they are just as good as the next person.”

Discussion and Conclusion

The purpose of this study was to inform our efforts to design learning opportunities for Black preservice elementary teachers that might positively impact their MI and VMT so that they can both experience and enact a “Black liberatory mathematics education ... that allows Black learners to flourish in their humanity and brilliance” (Martin, 2018). Results from our analysis suggest that Black preservice elementary teachers possess a strong desire to learn, understand, and use mathematics and desire mathematics experiences that center visualization and multiple approaches, consistent and authentic support, and a safe space for exploration. To support their development of a more robust MI and VMT, we aim to leverage these desires in our future design to perturb their focus on compliance over student- and discourse-focused exploratory mathematics teaching. While disheartened to be reminded of the myriad of ways Black learners are often negatively positioned and treated in mathematics learning spaces, we are taking these findings forward in our design to explore ways we might use the constructs of flourishing, humanity, and brilliance alongside justice-forward mathematics learning experiences that center the power of representation of Black liberatory mathematics and mathematicians.

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