Mathematical Identities and Foregrounds: Students' and Teachers' Perceptions of Racism and Mathematics

Identidades Matemáticas e Foregrounds: Percepções de Estudantes e Professores sobre Racismo e Matemática

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Abstract: This article is part of a larger doctoral study by the author. The research aimed to learn more about the relationship between mathematical identities and foregrounds for Black students. A goal of the research was to raise awareness between the connections of these phenomena and how it may affect the mathematics learning experiences Black students have, the perceptions they have about mathematics, and the importance mathematics has in their future outlook. During the analysis of this qualitative study there were four distinct themes that arose. I will discuss one of these themes, *racism*, and how students and teachers may perceive racism within varying learning contexts.

Keywords: Mathematical Identities. Foregrounds. Racism.

Resumo: Este artigo faz parte de um estudo de doutorado mais amplo do autor. A pesquisa teve como objetivo buscar compressões acerca das relações entre identidades matemáticas e foreground de estudantes negros. Neste sentido, se investigou como o aumento da consciencialização entre as conexões destes fenômenos pode afetar as experiências de aprendizagem de matemática dos estudantes negros, as percepções que eles têm sobre a matemática e a importância que a matemática tem nas suas perspectivas futuras. Durante a análise deste estudo qualitativo surgiram quatro temas distintos. Discutirei um desses temas, *o racismo*, e como estudantes e professores podem perceber o racismo em diversos contextos de aprendizagem.

Palavras-chave: Identidades Matemáticas. Foregrounds. Racismo

1 Introduction

This text serves as part of a larger doctoral research project conducted by the author. The theoretical framework of the study was based on the theories of *mathematical identities* and *foregrounds*, with a specific focus on Black students in middle school.

Black students are often viewed as uncapable when it comes to academics and mathematics, some of them are perceived to have minimal desires or motivations when it comes to learning, and/or low ceilings when it comes to potential of understanding mathematical concepts (Martin, 2009b; Valoyes-Chávez & Darragh, 2024). On many occasions, poor performance of Black students is determined through low assessment scores (Joseph & Cobb, 2019) or low achievement in mathematics courses further stigmatizing inability to do mathematics (Davis & Martin, 2018). These possible perceptions of ability can cause deficit framing of Black students and disruptions in their advancement of learning.

There has been much research on Black students' apparent low performance and seemingly lack of motivation in mathematics (Madkins & Morton, 2021; Matthews, 2010). Through two theoretical perspectives, Black students mathematical knowledge development can be stifled or neglected if they do not feel a sense of belonging (Matthews, 2020) or they are

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unable to identify with the mathematics in academic environments (Gonzalez et al., 2020; Legette & Kurtz-Costes, 2021). To have a sense of belonging allows one to feel safe, therefore facilitating the possibility to identify within a specific context or a particular group. This also provides more paths for the inclusion of all students in mathematics classrooms. Borges, Cyrino, and Nogueira (2021) claims to provide an educational environment that aims to be inclusive it cannot contain infrastructure, materials, assessments, spaces, professionals, educational tasks, etc. that are guided by division based on differences, but by sharing. Inclusive education can consider the identities of the students involved and provide an equitable learning experience that considers the perspectives of all learning participants.

Sharing to create spaces of inclusion in mathematics classrooms aligns to attending to mathematical identities of students. Carrijo (2021) discusses inclusive education through the perspective of immigrant students and raises the following points for consideration: mathematics classes in linguistically diverse contexts; teachers who teach mathematics as agents of inclusion; and themes with political and social implications in mathematics classes[2]. Adopting these aspects in the classroom connects to how learners communicate mathematics and make sense of the world around them, which allows them to share and makes part of their foregrounds and identities.

Identities have been profoundly researched, which has involved analysis of the beliefs and thoughts of individuals (Dean, 1997; Erickson, 1959; Nicolson, 2016; Poole, 2010) however, the concept of mathematical identities of students is still rather new in the field of mathematics education (Gholson & Robinson, 2019; Gonzalez et al., 2020; Martin, 2000; Matthews et al., 2014; Moore & Groves Price, 2015; Roberts, 2018; Varelas et al., 2012).

Below, I explore the theories of mathematical identities and foregrounds, and what they can mean through the experiences of Black students.

2 Identities and foregrounds

Identities are essential for development and are highly influential on the trajectory of a student's life. Gholson (2017) states that identities serve as the organizing link between macro-structural forces and the face-to-face moments in which we all live. In this sense, identities are composed of internally and externally imposed interpretations of ourselves through lived experiences or interactions, and these events occur through our socioeconomic and sociopolitical environments (Nasir & McKinney de Royston, 2013). The interactions and engagements that one can possibly have with mathematics depends on these environments that one is born into, how they come to perceive or be perceived in mathematics, their ability to participate, the options in mathematics that will be presented or barred to them, and the significance of interpreted meanings that arise in relation to mathematics.

Limiting access to an adequate mathematics education restricts students' access to opportunities and occupations as adults. For many Black students, their mathematics experiences are disconnected from their lived experiences (Martin, 2009a), the content and context in which they learn mathematics is not relevant to their lives or identities (Nasir & McKinney de Royston, 2013), the overall content of academic mathematics is limited and does not critically address sociopolitical factors that may affect their lives and the lives of others (Skovsmose, 2016).

Considering the social context of students is important when attempting to understand

[2] Translated by the author from the text Carrijo, M. (2021). *Educação Matemática Inclusiva no Contexto das Imigrações Internacionais* Seminário Internacional de Pesquisa em Educação Matemática, Uberlândia, MG.

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the mathematical experiences students have had and will have. One's social context includes their backgrounds. Within students' backgrounds are their experiences, aspects of their identities, and preferences of how to learn. Along with these characteristics of one's backgrounds, there can also be assumptions from external groups and individuals. Backgrounds can therefore prevent some from accessing further opportunities, therefore causing social, economic, and educational barriers, in effect altering students' possible futures and options.

In an academic context, Aguire and Mayfield-Ingram (2013) state that while teachers may affirm and support the racial, gender, cultural, ethnic, academic, and mathematical identities of students in classrooms, they should also be aware of the need to reframe negative views of the identities, which may reflect limited knowledge of students' background experiences and social realities. For example, in a country such as the United States where Asian Americans may be viewed as "model minorities", African American students may be viewed as having a cultural or racial background that does not value education (Aguire & Mayfield-Ingram, 2013), or viewed as inferior academically even if they have proven accomplishments (Battey & Franke, 2015; Martin, 2009b).

To be viewed as inferior can be a form of denial and violence. In a sense, one can consider the knowledge that students come into schools with to be their background knowledge. Knowledge can be informed by the schools that they attend, their homes, their communities, and their cultural backgrounds.

Matthews, Banerjee, and Lauermann (2014) suggest that academic identities can be viewed through two frames, the first of which is internally negotiated (i.e. how students tend to think of themselves as learners), and the second which is externally supported (i.e. how students feel in their learning environments).

Discussing mathematical identities includes considering how students may think and feel about academics. Mathematics is a topic area that is frequently assessed and can provide barriers for individuals if it is not understood (Björklund Boistrup, 2016). It can be structured in such a way that maintains White supremacy and neglects ways that Black students may relate to and understand mathematics (Joseph & Cobb, 2019)

The construction and formation of mathematical identities is an example of a type of identity which is imperative to build upon and sustain for academic success. Success in mathematics is reliant upon adequate mathematics education. Recognition of success in mathematics is completely dependent upon one's ability to perform well and demonstrate mastery on standardized state assessments; it is imperative to be aware of what practices may affect these outcomes (Davis & Martin, 2018). Understanding how students identify with mathematics may aid in this issue.

To understand the theory of mathematical identities I refer to Danny Martin's definition, which states:

> "[O]ne's beliefs about his or her mathematics abilities, one's beliefs about the instrumental importance of mathematics, one's beliefs about opportunities and constraints that exist to participate in mathematics, and one's motivation to obtain mathematics knowledge." - (Martin, 2000)

Using Martin's definition of mathematical identity, I understand it to be the perspective of mathematics and the value that mathematics can have in one's life, and the views that others may have on an individual - this can be for people of any age, which includes both students and

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educators. Based on what is understood about identity above, mathematical identities can continue to evolve over a lifetime and be constantly negotiated through social context or through self, specifically in regard to mathematics. But what does this look like?

Gonzalez (2020) states that: "It has been posited that mathematics identity affects one's perception of the discipline, one's academic identity and, ultimately, one's success in the subject."

Martin (2000) recognizes that this phenomenon is extremely hard to observe or analyze, and it is important for us to study and consider deepening our understanding about how individuals feel about learning mathematics and alternative ways in which people learn mathematics (Miller & Wang, 2019). We know that it exists in some capacity for us all, because we all have an opinion about mathematics and are capable of doing mathematics. But are we always permitted and encouraged to do mathematics in our own way?

To create channels to engage their identities with the subject of mathematics, students should be introduced to the work of mathematicians (Gonzalez et al., 2020) that is relatable to their realities, aspirations, and imaginations as well as their concerns, worries, and doubts. Unfortunately, this privilege eludes many Black students, consequently their relationships with mathematics can be further damaged through systems that may not appease their preferences, but may also oppose their interests and culture.

Mathematical identities of Black students are pushed aside and ignored through systemic structures, everyday occurrences of racism and anti-blackness, downplayed struggles of one's sociological location and conditions, and sociopolitical/socioeconomic status (Davis, 2022). The educational systems put in place are representations of policies and larger structures that aim to maintain the exclusion of Black people (Davis, 2022; Ray & Mahmoudi, 2022). These acts of violence and negligence towards equitable mathematics education for Black students is reproduced through their continued alienation, and ignorance to sociological realities.

Davis (2022) states that:

> "To fully understand the experiences of and challenges for Black adults and children in mathematics education, it is necessary to reach an understanding of race, laws, policies, education, and social customs […]. Mathematics education is a microcosm of a larger educational and social system predicated on race, law, and the exclusion of Black people that still exists in the present day." (Davis, 2022, p. 485)

Understanding the experiences and obstacles for Black individuals can reveal possibilities to create better opportunities to develop and learn through acknowledgement and awareness. In recent research, Anderson (2019) identifies the problem of African American males' struggles in mathematics being misunderstood because of life factors unaccounted for. These life conditions include one or more of: living in poverty, parents being unemployed, enduring poor living conditions, poor school conditions, lack of adequate academic resources, being exposed to domestic violence, and experiencing unstable of family life (Anderson, 2019; Campbell & Payne, 2023).

Considering these living conditions, I agree with Anderson (2019) that the task of learning mathematics is extremely difficult and may not be a high priority. These living conditions can have effects on students' identities and interest in school. This can also influence the perceptions of Black students in learning mathematics. I also think that there is more to

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explore here, as Anderson alludes to the need for us to provide a better and more relatable mathematics education for students, that prioritizes and includes students.

In addition to discovering more about Black students' learning and living conditions, and being empathic about these conditions, there is a need to take the time to understand how one comes to see and understand mathematics, and to view oneself as a mathematician - in other words, one's mathematical identity (Martin, 2000, 2009a; Roberts, 2018). This can be affected by the conditions in which a student lives, how they perceive their realities, and how mathematics interconnects with their lives, realities, and future opportunities.

So there exists a connection between students' lived experiences and how they come to see themselves as mathematicians - they always do so, but in different ways (Gonzalez et al., 2020). This has an effect on the way they might see their future, the options for their future, and the way they come to understand meaning (Skovsmose, 2014).What are my dreams, what do I want to do when I get older, where do I want to travel, who do I want to be? These are questions that students might ask themselves, or be asked, and the responses can be good or bad depending on how one subjectifies them. Subjectivity inherently requires one to listen and observe the narratives of others to attempt to understand - and certainly to acknowledge their thoughts and views. In this way, we can recognize the manners in which others contextualize their perspectives, experiences, and motivations in relation to mathematics (Valero, 2015).

To discuss these embodiments of lived experiences and how one comes to see oneself, I draw from Skovsmose (2012, 2014) and refer to these occurrences as their *foregrounds*[3]. The foregrounds of students are intertwined with how they come to learn mathematics. The way students learn mathematics, have experiences with mathematics education, and participate in activities that involve mathematics influences their perception of their ability in math and their motivation to participate in related opportunities (Gonzalez et al., 2020; Matthews et al., 2014; Valero, 2015). These perceptions and interpretations that individuals have can represent dreams or nightmares, positive possibilities, and obstructions in their lives (Skovsmose, 2014).

Foregrounds and mathematics identities are interconnected and may be ignored equally when it comes to their concerns in mathematics education for Black students. They may offer a possible way of making academic mathematics meaningful in their perspectives by taking a moment to understand their context, interests, and definitions of meaning.

Foregrounds becomes significant in this observation, because one can consider the multiplicities and potentialities which social contexts make possible for a person (Skovsmose, 2014). These multiplicities position students to envision the realities and possibilities they experience or are able to imagine for themselves (Stentoft, 2009). Envisioning these realities and possibilities involves the contrary as well - considering the absence of possibilities of realities.

The perspectives that can be created on one's social context are infinite, evolving, and subjective. One may come to see many opportunities within well-defined or objective forms of structured context. This all depends on an individual's disposition, and ways of coming to make meaning of their environment. That is, it depends on one's actions and resources, which are constructed sociologically, and how one uses their resources to manifest these actions. The subjectivities that are therefore possible are incredible and difficult to consider and analyze. A difficulty could possibly be possessing access to said resources and being unaware of the ways in which to leverage them. This can be a reality for many families that live in urban and

[3] The theory of *foregrounds* was constructed by Ole Skovsmose. See Skovsmose, O. (2014). *Foregrounds: Opaque Stories about Learning*. Sense Publishers.

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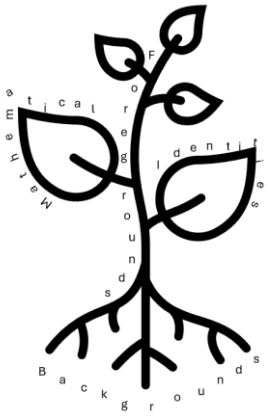
impoverished areas.

Perceptions are crucial because they are not only dependent on an individual's physical environment. One can come to think and perceive in different ways through experience and contact with other individuals and cultures. One can have a depleted source of resources but view the world as an abundance of possible outcomes while others may not be able to see this at all. Skovsmose (2022) tells us that to understand the actions of individuals we must look at their intentions, which are phenomena that are deeply rooted in social factors. I see these intentions as being influenced by perceptions which are also swayed by society and communal environments; intentions can also be subjective, as what one considers to be best for them may not be for another, or for themselves, depending upon the context and the situation.

The way that one identifies with mathematics influences how they may perceive their future possibilities, and the same can be true for the way they perceive their futures and how it influences their relationship with mathematics. Perhaps one can determine through their sociopolitical and cultural experiences that mathematics learning is not pertinent for their progression, or that it is essential for them to advance. One may know that it is important but not understand why it is, as many students may hear that "mathematics is very important", without an explanation, context, or developing a sense of ownership as to what makes it so important (Matthews, 2018). There is a need to make connections between learning, their experiences, and interests.

Backgrounds influence mathematical identities and foregrounds. Mathematical identities contribute to foregrounds, and foregrounds are affected by backgrounds. These concepts are in a cycle with one another, and they can very well move in different directions at various moments of life and development, where one concept may begin to sway the other two with more vigor. Figure 1 shows a cycle of Backgrounds, Mathematical Identities, and Foregrounds, what I refer to as the BMF cycle. Although they are intertwined and have the possibilities of overlapping (especially since they are all influenced by sociological factors), there are differences in them. Their interconnectedness is what creates the space for fascinating mathematics inquiries, possibilities, and additional ways of building interest for students. This can also be a possibility for creating spaces where Black students can grow healthy identities, spaces that consider themselves, identities, backgrounds, and foregrounds of different contexts.

Figure 1: Backgrounds, Mathematical Identities, Foregrounds Cycle (BMF Cycle)



The characteristics of these concepts are linked by thoughts, perceptions, and experiences. Our foregrounds embody where we come from and our communities, as do backgrounds of individuals. One can think of the backgrounds being the foundation of individuals, their "roots". As with the roots of plants that absorb the moisture and nutrients

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around them, so we absorb the knowledge and customs that are practiced around us. Our foregrounds can be seen as the stem that grows from our roots, as they are what peek beyond the ground into our future but are also part of our foundation in where we come from and how we envision the future. One can view identity as the flowers and fruits that bear from a plant. As our identities come to bloom like fruits and flowers, some come to form mathematical identities. One can also view the entire cycle of this growth metaphor as being a mixture of backgrounds, foregrounds, and mathematics identities - possibly as a single plant working as its own ecosystem, learning, and surviving its environment.

As students are growing, they may come in contact with environments that may be inviting or some in which may be in opposition of their cultural background. In some learning sites Black students may come to experience racism in various ways. Below I open discussion about the possible relationships between the notion of racism and mathematics education, and how this may interfere with the growth of Black students' mathematical identities and foregrounds.

3 Racism and mathematics education

The connection of race to mathematics education can be perceived through the lack of voice and representation of Black mathematicians, similar to the lack of Black professionals in mathematics and STEM fields (Madkins & Morton, 2021; Tate, 1994). This is the result of the paucity of opportunities for Black students in mathematics within our schools. This can be connected to the way that African Americans are assessed in mathematics and related to the way in which Blacks are portrayed in society as mostly entertainers or athletes, in contrast to academics, making it 'uncool' to participate in areas involving mathematics (Myrdal, 2017). The continuity of this type of system and prejudices of Black learners leads people to view them as incapable or only having the ability to excel in certain ways.

In the United States, for instance, those who are considered more competent in academics, especially in mathematics and sciences, are individuals who identify as White or Asian. The consequence of this assumption is the negative outlook that others may have of themselves when hearing that White and Asian people are more proficient in learning than other racial groups. This is typically communicated to Black students through a deficit perspective of disseminated assessment data based on racist ideologies (Madkins & Morton, 2021; Martin, 2009b, 2012). Consequently, Black people may not be considered competent when it comes to academics, especially in the sciences and mathematics (Myrdal, 2017).

This way of thinking is all too often mentioned through the "racial achievement gap", the "gap" that exists between the way that different races perform academically. The use of this statistic and narrative perpetuates deficit perspectives, racism, and the lowering of expectations for students (Martin, 2009a). As a result, teachers can lower their expectations when teaching Black students, basing their judgements on the students' backgrounds, possibly diminishing the potential for their foregrounds.

This assumption contributes even further to negative consequences because it can lead individuals to have less belief in their abilities to learn or to improve academically (Matthews et al., 2014), especially when this narrative is continuously used to measure aptitude. The occurrence of this assumption over decades has also normalized the idea that Blacks are not good at mathematics; at times this idea can be communicated knowingly or unintentionally through teachers or other staff in school buildings. Attending to the confidence and belief of students requires that their self-efficacy is positively sustained, meaning that asserting their racial identity and ability in mathematics may be highly beneficial for their success.

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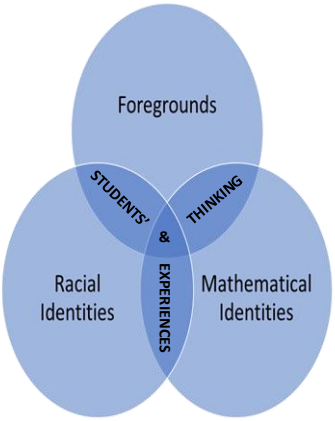
Strengthening the connection between a student's racial identity and mathematical identity should be one of the goals of teachers, school staff, and communities (Martin, 2009b). The perspectives that students and individuals have of themselves is a result of the experiences they are required to go through in school, as well as experiences in their communities.

The connection between their racial identities, mathematical identities, and possible futures are built upon their experiences and learned ways of thinking. Exploring the relationship between the theories of foregrounds, mathematical identities, and racial identities may provide insight on how it provides motive for Black students to learn mathematics. Developing an understanding of how experiences and thinking influence Black students' identification with mathematics may allow them to access more opportunities in relation to mathematics. Figure 2 shows a possible way to think about these theories conjointly centering students' experiences, preferred styles of learning, and ways of thinking.

Figure 2: Overlap of theories and experiences



Conversely, academic mathematics typically involves being lectured on how to do the mathematics; students are treated only as receivers of knowledge and not producers (Marshall et al., 2022). In most curriculum, it does not consider all the students it will inform, therefore does not serve their best interests (Martin, 2009a). It limits the ways in which Black students are allowed to explore mathematics in school and can possibly affect the way they will view mathematics in the future, if there are not additional opportunities outside of school. Students are told how to do mathematics in a certain way, how to perform well on an assessment, and if they perform poorly in either circumstance they are labelled as such - poor performers, or incapable. To guide Black students through their mathematics learning there is a need to take a deeper look at the mathematical content, practices and participation (Martin, 2000); as well as supporting students where they are and considering the knowledge they are capable of contributing.

4 Methodology

This study is qualitative and ethnographic. The data in this research was produced using two online meeting platforms, Cisco Webex and Zoom. The interviews took place after school and were recorded using the online cloud feature. Interviews were transcribed by the author using the Descript application.

The methods selected to carry out this research are varied, as this study takes inspiration from multiple theories when viewing and analyzing the data. In this study, interviews are conducted, artifacts are created by the students, relevant cultural texts are created by both teachers and students, and observational notes of the different emotions and reactions during

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the interviews are recorded by the researcher. The stories and experiences that participants share, including those of the researcher, are valid and valuable to the progression and contributions of this investigation. All the texts and artifacts provide possible further elaborative explanations of how one can come to look at the foregrounds and mathematical identities of Black students. In this way, this study is qualitative and ethnographic, as artifacts and texts are used from their perspectives and thoughts to produce knowledge and voice their stories (Denzin & Lincoln, 2005; Moerman, 2010; Schensul & LeCompte, 2013).

The general goal of this research is to learn more about the development and growth of African American students' foregrounds and the correlation between their foregrounds and mathematical identities, as well as assisting in building their confidence in mathematics.

The population of the study are Black and impoverished students, and their teachers, in Newark Public Schools (NPS) in the city of Newark, NJ. The students are in grades 7-8; this includes students aged 12-14. I have experience working with this age group as a 7th grade mathematics teacher and grade K-8 mathematics coach; my assigned focus as the coach was to primarily support the middle school math teachers, who teach those aged 10-14 (i.e. grades 5-8).

5 Analysis and themes

The study examines the role of mathematical identities and the correlation of foregrounds, the perceptions of Black students' abilities and those of their teachers, and how one perceives one's own ability to succeed. Because of my interest in understanding identities and foregrounds, to analyze the data I used a blend of thematic content analysis and narrative analysis.

Various interpretations and inferences can be made from content and experiences that are shared verbally. One can analyze tone, body language, and the words used to describe said experiences. Thematic content analysis considers the distinctive themes that are deducted from the data by the researcher (Wheeler, 2022).

Through discourse, individuals can communicate their experiences and perspectives. Williams et al. (2009) argue that it is possible to understand how aspirations can evolve, how identities grow, and how key moments are said to deflect trajectories in significant ways for the students through the analysis of their narratives. Thornborrow (2023) states that: "We structure our experiences, account for our actions and display our understandings of the human condition to others through the stories we tell." Discourse gathered from participant interviews can be used to gather information about the core narratives and counter-narratives, therefore opening up pathways connecting to individual narratives and the given investigation (Thornborrow, 2023). Through narrative analysis, one can observe different processes of social identity construction.

Through the analysis, many themes arose, the four principal themes that I noticed were: *racism*, *speed obsession*, *learning environments*, and the *evolutions and deformations of foregrounds*. In this text, I will remain focused on the theme of *racism*. Below are excerpts from interviews with the students and teachers who participated. They share the different ways in which they have perceived racism revolving around their experiences with mathematics and as learners.

Racism

Observations of negative mindsets in relation to mathematics from Blacks does not

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describe all the mathematical experiences and identities of 100% of the students I have or had, nor do I think it describes the standing or outlook of all Black students in other urban school environments. Another possibility is that students that do well may feel the need to prove that they are indeed smart enough. In this sense students feel the need to prove that they too belong among those that are competent in mathematics. Students may also feel that there is no connection between how they identify racially and their ability to do mathematics.

In this study, the aim is to understand how students identify with mathematics and how it influences their future goals, more specifically for African American students, and how their racial identity may influence their thoughts of their abilities in mathematics. During the data analysis there were various students that felt as though they were good in mathematics and some stated that mathematics was their favorite subject. An intriguing finding in the data is that most students identified positively with mathematics, even if they did not particularly like mathematics or it was not their favorite subject. I asked the students about their ability to do math and the correlation between how they identify racially and there seemed to be doubts, but they maintained their confidence about their ability in mathematics.

A student, *Petunia*, identifies as both Latina and African American. *Petunia* informs me, "[M]y grandparents are from Puerto Rico and Peru, and they're also African-American well, one of them and then the other one is ethnicity is like from Peru and stuff like that." *Petunia* is a 7th grade female student. Our discussion below explores the connections between racial identity and mathematical identity, as well as how she feels in thinking about this comparison and her opinions on the matter.

> *Jamaal*: What connections do you see between your racial identity and your performance in mathematics?
>
> *Petunia*: Um, I dunno, like, um, I don't know. A lot of the time I feel underestimated because of where I come from and I just. I just like to prove people wrong and doing good in math helps me with that to prove people wrong. And it really has helped me become who I want to be. And like what I want to do. Like, I want people to look at me differently than what they did look at me like.

Above *Petunia* admits to the stress and extra mental load of thinking of the need to prove others wrong, and others may look at African American students as if they are not as capable when it comes to mathematics. In *Petunia's* response I also observe strength and responsibility as she makes a connection between her ability to learn mathematics and her future desires (Skovsmose et al., 2018). *Petunia* wants to be recognized and respected as a mathematician and competent student.

Another student, *Michelle*, who identifies as both Hispanic and Black had this to say when asked the same question:

> *Michelle*: Well, that's a good question. Um, racial identity wise with working as math, I have seen people outside looking at me when I'm helping my dad calculate something, looking at me like I'm weird because I'm Hispanic. It's based on my race. So, I would see myself having a little bit of issues depending on the person.

Michelle notices and feels that people may give her strange looks when she is doing mathematics. Here she is describing an example of helping her father with calculations, which

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it seems she enjoys doing, as she mentions it multiple times during the interview. In this case, although it takes place outside of the classroom, she correlates an awkward look while doing mathematics to be in relation to her racial identity. Although it seems like a fleeting moment, occurrences like these can be common and become a trending thought or preconception, possibly influencing future outlooks.

Experiences such as these can cause one to feel a sense of inferiority. This experience was based on race for *Michelle*. Blatant - or overt - actions of racism are not common everywhere in the United States (Doane, 2006), but certain experiences can leave one feeling estranged in their surroundings. In *Michelle's* response, one can also see that she is aware that due to her race, she could be viewed as "weird" within the hierarchical structure of mathematics (Martin, 2009b).

Tiana shares the same sentiments about possibly being doubted because of her skin color when asked about her future and if there would be any obstacles for her. Below she shares with me:

> *Tiana*: I feel like that there will be, for some reason I don't, I'm not sure if this is actually gonna happen. I feel like some people are gonna judge me by the color of my skin, basically racism or so, like people saying I'm not smart enough or I'm not like some people that, that's trying to put me down to what I really wanna do.

Tiana states that she does not know if this is something that will occur for certain, but it is something that she has observed before or heard about. Unfortunately, this can become an extra weight on a student during the process of learning. Additional stress can infiltrate from a multitude of sources and influence students' racial and mathematical identities. Due to systemic and sociological structures, students can come to feel that they are not "smart enough". This is due to decades of perceived intellectual deficiencies (Gholson & Wilkes, 2017) based on prejudice and racism (Du Bois & Zuckerman, 2004). Gholson and Wilkes (2017), just like *Petunia*, claim that mathematics posits an opportunity to indeed show their cognitive status, and that they are smart.

Ray and Mahmoudi (2022) claim that racism occurs primarily on three different levels[4], I remain focused on the first level here, individual, where racism operates via attitudes and face-to-face social interaction. However, in these moments there are individuals who may not be the target of a racial attack or insult, but perhaps, racist actions are observed or are shared with a person whom that victim is close with. These instances of racism can have lasting effects on people, and in varying ways, can leave one damaged and quite possibly change their perspective on the world. This can have lasting effects on how one may view themselves or how they come to view others.

In the interview with *Tiana*, she shares an experience from her older cousin whom she is close with. Through their words, tone and body language during the interview, it seems that these moments shaped their thinking around how things are or can be when it comes to presumptuous thinking involving race and academics, as well as what the truth can be for people in other contexts. Her cousin expresses to her that she has had to deal with racism, and *Tiana* anticipates that she may have to deal with similar treatment. *Tiana* tells me:

[4] The three levels that racism operates on that Ray and Mahmoudi (2022) refer to are individual, processes and mechanisms, and on structural levels via social institutions.

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> *Tiana*: No, but my cousin, as I said before, she's been through this and I'm scared that I'm gonna be through this too. Cause she's still going through it. She's telling me that she's getting used to it, but she still doesn't like it. I wouldn't like that either.

This experience of knowing someone close to her who shares similar physical traits is worrisome for how she may also be treated in other environments. This, in a sense, is reassuring that the current school space and community are safe zones for her, as this is something that she anticipates will happen, and has not occurred to her personally as far as she has noticed.

Heather shares her experiences with racism as well:

> *Jamaal*: Have you ever observed any doubts or praises for your racial identity and your ability to do mathematics?

> *Heather*: Um, no. I would say no. I've been, I would say for the most part I've been fortunate, in math. I like math. I've always liked math. Even like in college, I had a Black professor for my math teacher. High school, I had a few Caucasians in elementary, I had predominantly Black, they weren't male, but I had predominantly Black teachers. So, I don't think that really impacted me. Sometimes I see it. The attitude. Yeah, I don't see it in the sense that like, when we look, at like, test questions and like the biasness or, just when you just look at the real world, right? You look at all the examples past, not so much present, but you know, you can see the biases, but I've never, I don't feel, I've never really experienced it. Like, I've been fortunate in that way. You know what I say that, and this, not mathematically, but I remember in high school, talking, having a meeting, and they were saying that others felt as if the person was rushing me along. I went to predominantly White high school. The person was rushing me along and they were like, that's rude. But maybe I was just oblivious to it. Like I didn't even, like, it was a after.

To *Heather*, encounters with racism are more of an occurrence from the past. In her opinion, assessments and current day education do not present racialized forms of experience for Black students. However, it appears to have positively affected how she approaches the subject matter of mathematics. *Heather* had many models of Black mathematicians and educators in her academic career, a level of representation that researchers state is often absent yet important for Black students' mathematical development (Martin, 2000, 2006; Matthews, 2018). At the end of her reflection, it appears that she started to perceive that there may have been a few moments of discrimination in her life that she may not have previously been aware of.

6 Final remarks and next steps

Awareness of an issue is the first step in moving toward solutions. Attention is being raised in recent research to the racialized experiences of Black students in mathematics education (Valoyes-Chávez & Martin, 2016) and education (Carter, 2022). Through the perspective of participants, racism in and outside of school settings can be sensed. There are underlayers of racism, possibly both intentional and unintentional, in our school systems and there is a need to improve circumstances for staff in schools and give guidance about attending to the development of racial and mathematical identities at all levels.

There is a feeling of the presence of racism from both students and teachers, whether they are the direct targets of racial violence or not. Unfortunately, they are in a position in which they must anticipate and be aware of racial tensions. Fortunately, it does not seem to deter any of the participants from the possibility of finding success in the future, even it racism does

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present a type of obstacle for them.

Sharing their experiences helps to raise awareness, not only for the participants or learners but for those who may only be observing or on standby. Through awareness action can be made to create an equitable learning space for Black students, such as discussing their experiences in spaces that are safe and do not perpetuate division (Borges et al., 2021), or having opportunities to express and value their identities.

Black students should be encouraged, empowered, and supported in their mathematics learning. Curriculum and assessments that students engage with should be aligned with their cultures, not in opposition to them. They should feel like they are mathematicians, because they are, not to be posited as low performers, incapable, or weird because they have found in interest in mathematics.

The ways in which Black students identify racially may affect the ways they develop relationships with mathematics. This will then affect how they come to think of their futures and whether it will be in relation to mathematics or not. It is important to develop an awareness about this connection for all to be aware as opportunities in mathematics are too often eluding Black students and their potential.

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