

# **A Critical Race Theory analysis of lack of access and representation in physics education through counterstory**

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There is a lack of physics courses offered in school environments where there is a majority of racially minoritized students at the secondary level. The lack of access for many racially minoritized students results in a lack of representation and exposure to physics. Based on my experiences as a student and faculty member in physics education, I recognize the systemic issues that play a role in access and presentation. This paper's Critical Race Theory (CRT) lens helps us further understand the causes of racial inequities within physics education. Specifically, I share a narrative of my experiences in physics education that illustrates the indirect and direct marginalization of racially minoritized students within the physics education culture. I then analyze my experiences using the CRT tenets of racism as endemic and normalized, interest convergence, and whiteness as property. I use my narrative to shed light on the larger systems of access and representation in physics education.

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## 1. Introduction

*“Physics was never pressed on me. Guidance counselors at my school would select who could and couldn’t take Physics classes at my high school. I should have been asked to take Physics; we should have been given the option to take it or not.”*

Black Americans have been historically underrepresented in physics. A 2019 report by the American Institute of Physics (AIP) found that between 1995 and 2015, Black Americans earned only 2% of physics bachelor's degrees and less than 1% of physics PhDs.<sup>1</sup> These figures contrast with overall percentages, where Black Americans accounted for 12.7% of all bachelor's degrees and 7.6% of all PhDs.<sup>2</sup> The 2021 AIP report indicated that the representation of Black physics professors was not proportional to the U.S. population or even the percentage of Black physics graduates.<sup>3</sup>

The underrepresentation of Black physicists and physics educators in the U.S. is a complex issue tied to multiple institutional factors. Historically, Black individuals were systematically denied access to quality education in the sciences through legalized segregation<sup>4</sup> and discriminatory admissions policies.<sup>5</sup> Black students are less likely than white students to have access to advanced STEM courses.<sup>6</sup> Without exposure to STEM subjects, pursuing advanced degrees in physics is more challenging.<sup>7</sup> Stereotypes about intellectual abilities can deter Black students from persisting in physics.<sup>8</sup> Frequent encounters with microaggressions or overt discrimination also erode Black youths’ confidence and can lead to feeling isolated.<sup>9</sup> In post-secondary education, Black students likely face institutional barriers, including lack of mentorship and discriminatory admission.<sup>10</sup> An unsupportive environment, such as experiencing microaggressions or a lack of representation, recognition, and mentorship, can also affect progress in the field.<sup>8</sup> Interventions are needed to increase representation – from early education outreach programs to institutional reforms and broader shifts toward equity and inclusion.

Given the multivariate issues, there is a need to understand better how racism operates within physics and physics education. I use counter-

storytelling<sup>11</sup> to share how I found my way toward physics as a Black youth despite educational obstacles. As a physics education researcher, I have witnessed how racism has operated from elementary school to higher education. In this paper, I specifically focus on my experiences in the primary and secondary years to describe how racism operates during foundational educational experiences for physicists and physics educators. Specifically, I summarize my educational experiences and use Critical Race Theory (CRT) as a lens to analyze how systemic racism created barriers to access and representation, offering insights into how systematic racism can impede Black youths' paths to physics.

## 2. Theoretical Framework

CRT in physics education offers a lens to explore how racism intersects with physics education. The central tenets of CRT are *intersectionality*<sup>12</sup> - the intersection of race with other social identities; the *permanence of racism*<sup>13</sup> - recognition of systemic barriers to access, *interest convergence*<sup>14</sup> - promoting equity which burden non-dominant groups at the benefit of dominant groups; and *counter-storytelling*<sup>11</sup> - allowing marginalized people to disrupt racist narratives by describing their experiences of exclusion and isolation.

CRT exposes implicit bias.<sup>15</sup> Every field, including physics, is laden with prejudices. By employing CRT, these subtle racial biases, which permeate grading techniques and the research opportunities presented to students, can be brought to the forefront.<sup>16</sup> CRT contextualizes the sociocultural erasure that persists in education. It recognizes how notable contributions of non-Western and Black physicists are often overlooked.<sup>17</sup> CRT offers the means to address these omissions, making it possible to understand how racism operates in these spaces.

## 3. Method

I employ narrative inquiry<sup>17</sup> and counter-storytelling by including my journey navigating the culture of physics as a Black man during my K-12

experience. CRT upholds the notion that the lived experiences of people of color offer valid and crucial insights into understanding systemic racism, viewing this knowledge as an asset.<sup>18</sup> By sharing my firsthand experiences, I complement and underscore the broader research highlighting challenges in access and representation faced by Black individuals in physics.<sup>8,19,20,21</sup>

To write this narrative, a critical colleague asked me about my life history, probing to understand my experiences in schooling and the discipline of physics, including experiences with racism. I then transcribed my responses and analyzed data deductively using the tenets of CRT, examining how race, power, and systemic racism intersected with my life history. I then summarized my experiences into vignettes along a timeline, centering storytelling in alignment with life history methodology.<sup>22</sup> My study aims to leverage my elementary and secondary educational experiences to advocate for including a CRT lens within the physics education research community. This study also offers insights into how foundational educational experiences play a role in Black children's pathways into physics. Below I describe key moments in my K-12 education, beginning with a vignette of an important experience which I then unpack through a CRT lens.

#### **4. Elementary years: An outsider at a predominantly white school**

*From a young age, I felt like an outsider at school. I attended a Catholic school, where I was one of the few Black kids. Around 4th grade, I started getting into many physical fights, and I didn't know what I did. I was called racial slurs. I was ridiculed for my facial features. I wasn't doing well academically. I was more focused on being accepted than performing academically.*

Race, power dynamics, and ingrained racism shaped my experiences in school from a young age. My mention of Catholic schools being de facto-segregated highlights issues with access and representation. My parents wanted to enroll me in a higher-performing school, and it is commonly perceived (and normalized) that predominantly white schools are better than

predominantly Black schools. Furthermore, my experiences of being singled out, subjected to racial slurs, and mocked for my appearance reflect the prevalent racist perceptions. Such experiences resulted in physical and emotional confrontations, which affected my academic progress. Using the CRT tenet of the permanence of racism, I recognize how societal racism and segregation were ubiquitous in my schooling. This isolating experience continued through college and today as a physics professor, where I am often the only person of color in the room.

Additionally, during my elementary years, I was overlooked by teachers and fellow students. Being ignored reduced my motivation to succeed academically; instead, I spent more time trying to fit in. In order to fit in, I became a class clown, moving further away from academic pursuits. This happens to many Black children who want to feel part of something bigger than themselves.<sup>9</sup>

Using the lens of intersectionality, my experiences with normalized racism in elementary school are aligned with research on young Black males in school, where academic and behavioral performance expectations are lower than students from other races and genders.<sup>12,23</sup> The fact that my best option for attending a higher-rated school was a predominantly white Catholic school serves as evidence of systemic racism, wherein high-rated schools often correlate with predominantly white spaces. The experiences I share here and analyze through a CRT lens illustrate how Black youth are overlooked and discouraged from academics, including physics.

## **5. Middle and high school years: An outsider at a predominantly Black school**

*In middle school, my parents put me in an all-Black Catholic school. Going from a predominantly white to an all-Black school was even more of a culture shock. Several of the students at the all-Black school ridiculed me for not being “Black enough.” This influenced how I interacted with everybody. I still felt like I was not included. I would get into fights and be a class clown in junior*

*high to try to fit in and be accepted. But it didn't work, I still did not feel accepted.*

I faced significant barriers to pursuing physics despite transitioning to a Black environment. During my time in high school, I dealt with overt racism, being called names such as: “Oreo,” “Uncle Tom,” and “Clarence Thomas,” and being told I was “too White.” A CRT lens makes clear the permanence of racism in my secondary school experiences and how aspects of whiteness were still predominant in an all-Black school. As a result of racism and micro-messages, I felt that Black males were not expected to do well academically or obtain leadership roles at the school, church, and broader community. The only spaces where Black youth were recognized were in sports and music. From my vantage point, the expectations of most Black males at my high school were that they would be undisciplined and deviant.<sup>24</sup> If one deviated from that culture, they were ostracized and viewed as not being Black enough, aligning with my vignette.<sup>25</sup> When considering the tenet of interest convergence, only when Black people excel in non-academic areas, such as sports, are they embraced and accepted by the majority.<sup>26</sup> This type of climate can deter students from pursuing careers in physics out of fear of being ostracized by their racial group.<sup>27</sup>

Through the CRT tenet of intersectionality, my identity as a Black boy who was viewed as darker skinned also shaped how others viewed me.<sup>28</sup> My experience is similar to most Black people, which Howard and Reynolds<sup>29</sup> describe as being “in perpetual negotiation as they seek to reconcile their individual lived experiences with prescribed societal expectations and limitations” (p. 236). I was not exposed to physics until after high school because administrators (the guidance counselor/principal) never enrolled me in these courses. This was an example of intentional gatekeeping by school administrators. Looking at this through a CRT perspective, I recognize that a system was in place that determined who had access to physics in high school based on identity. These experiences have shaped how I position myself today within physics spaces, specifically how I develop relationships with colleagues, administrators, and students.

## **6. Discussion**

CRT underscores the systemic inequities that students of color encounter, ranging from access to prime preparatory courses in their formative K-12 years<sup>7</sup> to differentiated experiences in undergraduate and graduate programs.<sup>8</sup> The stories I share above illustrate how systemic racism created obstacles in my early education to pursue a later path in physics. My narrative illustrates the omission of an inclusive environment and the disregard of Black students within physics, with minimal expectations placed on them. Beyond examining the exclusion of Black men in college and graduate physics courses, it is important to understand the experiences these men faced in their earlier education. These examples can be reflected upon to consider the long history of exclusion and neglect that Black men face in education and how to engage in more inclusive practices.

CRT can act as a conduit for initiating critical discussions about race within the physics classroom and higher education spaces, where we assess expectations placed on Black students and examine why they are still underrepresented in physics. Additionally, there needs to be an examination of the systemic factors that shape Black students' perceptions of physics and the reasons behind their unwillingness to participate. CRT also challenges the established status quo, encouraging the critique of age-old norms and methodologies in physics education. This could spearhead reforms that shift the scales towards more equitable practices. Lastly, CRT promotes interrogating norms and recognizing when and how people are excluded. By identifying and redressing racial imbalances in physics using CRT, there is scholarly potential for developing strategies that increase representation. With historical and current racial disparities persisting in academia and industry, CRT offers invaluable tools and insights for transformative change.

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