

# *Barriers to belonging for racially minoritised students in STEM higher education*

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# **BELONGING AND IDENTITY IN STEM HIGHER EDUCATION**

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# Barriers to belonging for racially minoritised students in STEM higher education

Billy Wong, Meggie Copsey-Blake and Reham El Morally

## Introduction

In university settings, racism is structurally embedded and can materialise as racial microaggression, racial stereotypes, social exclusion and marginalisation. In science, technology, engineering and mathematics (STEM) disciplines, racism can hinder the belonging of students from minoritised ethnic backgrounds at university. This chapter explores the views and experiences of 42 racially minoritised undergraduate students in STEM higher education. Informed by critical race theory (Crenshaw, 1989; Gillborn, 2018), we explore the barriers that appear to undermine student belonging. We discuss prominent issues, including regular experiences of racism and unwelcoming environments. We also discuss the perpetuation of whiteness and the lack of diversities and ‘people like me’ in STEM, including amongst student and staff populations and on the STEM curriculum.

In university contexts, these issues can cause students to feel ostracised, isolated and demoralised, dampening their feelings of belonging, including in STEM disciplines. By highlighting the lived experiences and challenges of racially minoritised students, we make suggestions for policy and practice to mitigate these existing barriers, and revisualise STEM education and the university as spaces where belonging can be experienced by everyone. In the UK, the decolonisation agenda aims to address racial inequalities and support the belonging of racially minoritised students in higher education. This involves being critical

in relation to whose knowledge is recognised and represented, what is taught in universities, and which pedagogical approaches are used and why some forms of knowledge are privileged over others (Schucan Bird & Pitman, 2020). As we argue in this chapter, universities require a long-term, cultural and institutional shift towards decolonising their systems, behaviours and practices. However, immediate changes are also needed to address racism and support the belonging of racially minoritised students, including in STEM higher education.

## The STEM context

There are concerns that a greater proportion of students from racially minoritised backgrounds are dropping out of STEM education compared to their white counterparts (Advance HE, 2020; Elias et al., 2006). Recent research indicates that the reasons for this ‘leaky pipeline’ lie in various factors and social inequalities.

In the UK, and similar Western countries, one of the main challenges for racially minoritised students in STEM education is that these fields are historically (but also presently) dominated by white people, especially white men. Underrepresentation and marginalisation can create feelings of isolation and disconnection amongst students, including racial and ethnic minorities, women and gender minorities, and individuals with disabilities. A lack of representation can perpetuate racist stereotypes and biases, and fewer opportunities for racially minoritised students to develop belonging and identity, which leads to further feelings of exclusion and marginalisation (Ong et al., 2018).

Furthermore, it is important that racially minoritised people are represented on the staff, as positive role models, mentors and academic support networks can be a powerful source of inspiration and facilitate career progression amongst marginalised students in STEM, especially Black women (Inyang & Wright, 2022). However, people from minoritised ethnic backgrounds are underrepresented as professors in higher education. This is especially true of women, of whom most are in the social sciences, as the lack of diversity in STEM is marked (HESA, 2022). For instance, the Royal Society of Chemistry (2022; Ghosh 2022) reported just one Black chemistry professor in the UK last year. This has implications, as racial and ethnic diversity can affect belonging, motivation and achievement (Graham et al., 2022).

Existing studies have also found that students with underrepresented identities, including students from minoritised ethnic backgrounds, are more likely than other students to experience feelings of being an imposter at university (Murray et al., 2022), where they do not feel as though they belong or can succeed in STEM fields. More specifically, the culture of most STEM fields is often different from that of other, non-STEM disciplines. STEM disciplines tend to be highly focused on research and discovery, typically underpinned by a positivist approach and objective mindset which tends to assume scientific knowledge is universal or value-free. This approach tends to be uncritical of the factors that shape scientific knowledge, overlooking its vast global implications, perspectives and histories (Smith, 2021), and highlighting unique challenges and assumptions about decolonising the STEM curriculum in the UK.

Consequently, racially minoritised students may struggle to identify with or align their values with how certain ideas or knowledges are presented to them in STEM contexts. Positivist and objective approaches to learning are often used in STEM, but these may not appeal to students who are more accustomed to collaborative or interpretive approaches to learning. For example, STEM degrees, especially those with lab work, often require students to work in isolation or in small groups, or for long hours, which can make it difficult for some students to develop social connections and a sense of community, especially those with other commitments, or those with few or no peers from similar backgrounds in their classes (Keller, 1992; Ong et al., 2018).

Moreover, racism and racial inequalities persist as an everyday reality for students from minoritised ethnic backgrounds in higher education, manifesting in various forms across time and space, in different contexts and disciplines (Wong, Chiu et al. 2023; Wong, El Morally, Copsy-Blake et al., 2021). Whilst this is a collective problem that requires institutional change and long-term collective action, immediate action is also needed, as the consequences of racism are current and ongoing, and damage the belonging of students in university settings. Whilst belonging is inevitably nuanced and context-specific, the experiences of racially minoritised students in STEM disciplines are underresearched in UK literature.

## Student belonging and racial inequality in higher education

Although scholarly definitions are widely contested and varied, the concept of *belonging* can be understood as feeling accepted, affirmed and valued by a group or community, and is often associated with the basic human need to connect with others and feel included. Yet racism, even when manifested in its most subtle or implicit forms, presents significant barriers to belonging for racially minoritised students in higher education.

In education research, *belonging* is typically ‘measured’ in terms of a sense of group membership, and of the extent of academic engagement and social integration in university settings, which includes utilisation of support provisions and resources (Ahn & Davis, 2020). According to Gravett and Ajjawi (2022), belonging is situated, relational and processual. Student belonging is often positively associated with different aspects of student experiences, including well-being and academic achievement (Read et al., 2003). Research on student belonging fills an important gap in the understanding of students’ experiences and outcomes. However, few studies have unpacked how structural inequalities and manifestations of racism affect the belonging of racially minoritised students. We use the lens of critical race theory to focus on the barriers that seem to inhibit student belonging in STEM higher education.

To elaborate, the underrepresentation and apparent underachievement of minority ethnic students suggests that the current higher education system in the UK privileges and favours the belonging of White British students (Bunce et al., 2021). However, existing research appears to underplay ethnic differences, and not to acknowledge the potential barriers for students who may struggle to feel socially accepted or valued by their institutions, especially when there is evidence that racism exists as an everyday lived reality for students in UK universities (Equality and Human Rights Commission, 2019). This assertion is supported by an extensive range of case studies of education-to-work trajectories that highlight the intersections of race and ethnicity (Arday & Mirza, 2018; see also Al Arefi, Chapter 10 in this volume).

In university settings, racism is often disguised by being covert, implicit or subtle. For example, racial microaggressions have long been the focal point of scholarship on the racialised experiences of minority ethnic students (Singh, 2009). The consensus is that these subtle forms of racism serve to marginalise and negate the identities of racially minoritised students, typically in ways that are normalised in society, which makes



them harder to identify or call out. Though microaggressions are often tolerated by bystanders, or at least by the majority, evidence suggests that they can prompt isolation, perplexity and low self-esteem (Harris, 2017), and can be more damaging than explicit forms of racism, such as overtly racist comments (Jeyasingham & Morton, 2019).

A recent inquiry into racial harassment in UK universities (with 845 student responses) found that 24 per cent of students from minoritised ethnic backgrounds reported experiences of racial harassment, whilst 56 per cent had been subjected to racist name-calling, insults and ‘jokes’ (EHRC, 2019). For these students, higher education is a journey of racial challenges and inequalities; this is further evidenced by the ethnicity degree-awarding gap, that is, the percentage of ‘good’ degrees (class 2:1 or above) awarded to the white majority and to racially minoritised students, even when prior attainment and entry grades are controlled (Universities UK/National Union of Students, 2019; Wong, El Morally & Copsey-Blake, 2021).

The growth in the number of students from minoritised ethnic backgrounds in higher education has enabled the disruption of these previously normalised discourses, institutionalised cultures and pervasive ways of thinking. Student-led initiatives such as the ‘Why isn’t my professor black?’ (Jahi, 2014) and ‘Why is my curriculum white?’ events (Peters, 2015) have illustrated that whiteness is perpetuated by the university curricula and the underrepresentation of Black academic staff. The decolonisation agenda has been strengthened through such campaigns, which draw attention to the colonial histories and structures of higher education, and the existence of white supremacy and racial hierarchies. Universities therefore require a long, collective process of unlearning and undoing centuries of colonial ideas, practices, behaviours and systems (Bhambra et al., 2018).

The intersection of race and ethnicity is therefore key in research that attempts to understand student belonging. For instance, a recent study of the experiences of Black students in STEM higher education in the UK found that they often feel unwelcome at university because they are underrepresented in student and staff populations. The researchers suggest that students can benefit from a greater diversity of teaching and assessment approaches in STEM disciplines, and from moving away from traditional lectures and towards smaller teaching groups (Greaves et al., 2022).

McClain (2014) suggests, from a small qualitative study of Black mathematics undergraduates, that an absence of Black peers caused them to feel like outsiders, and that experiences of racism and negative

racialised stereotypes served to other and isolate them further. These factors have serious implications for the belonging of those who are underrepresented in their degrees, and, more broadly, within high-tariff universities with poor ethnic representation ([Advance HE, 2020](#), p. 138; see also Hyland, [Chapter 2](#) in this volume).

## Critical race theory

A key lens to interpret the experiences of racially minoritised groups is critical race theory (CRT), which acknowledges and accepts that racism exists and is central to social inequalities. CRT is a useful theoretical framework, as it effectively destabilises notions of race and racism, and challenges normative or dominant institutional discourses ([Solórzano, 1998](#)). There are several key commentaries that conceptualise the central tenets of CRT similarly (e.g., [Crenshaw, 1989](#); [Crenshaw et al., 1995](#)). A key perspective is the notion that racism is structurally embedded and ingrained in society and exists as a product of social thought and colonial imagination. However, as [Gillborn \(2018\)](#) notes, racism is fluid and cannot be solely understood as a depersonalised system, as it operates on the beliefs, actions and fears of individual actors. The barriers to belonging for racially minoritised students must therefore be contextualised if any intentional or meaningful change is to be actioned.

Relatedly, intersectionality theory – coined by Kimberlé Crenshaw to challenge single-axis anti-discrimination doctrine in the US – was developed to acknowledge the unique racialised and gendered experiences of Black women ([Crenshaw, 1989](#)). Over time, intersectionality has become a popular lens through which to examine the interconnectedness of different social inequalities and identities in Western contexts, especially in education and social science research. For instance, an intersectional feminist approach recognises that students can experience multiple axes of oppression based on race, ethnicity, gender, class, disability, sexuality and more. However, these inequalities are often siloed, and the unique complexities of intersectional experiences can be overlooked in the literature. Similarly, the centrality of racism and white supremacy as deeply rooted in global inequalities can be absent in studies that adopt intersectional frameworks without deeper insight into their origins in CRT and Black feminism. Within intersections of race and ethnicity, there are interconnected inequalities between ethnic groups, which merit closer insight.

Our focus is on the barriers to belonging for racially minoritised students in STEM higher education. We suggest that racism manifests as unwelcoming university environments, social exclusion and marginalisation, and a lack of ‘people like me’ in STEM. We aim to expand our knowledge of these challenges by providing deeper empirical insights into the lived experiences of racially minoritised students at university.

## Study details

Data in this chapter comes from a three-year (2018–21) qualitative project that investigated the lived experiences of racially minoritised students in STEM undergraduate degrees. The project aims to improve understanding of their views, experiences, opportunities and challenges at university. According to Advance HE (2020, Table 3.6), around 24.3 per cent of all UK-domiciled university students self-identified as being from a minoritised ethnic background, with 25.6 per cent in STEM and 23.1 per cent in non-STEM degrees. In other words, racially minoritised students appear better represented in STEM disciplines, at least in terms of access statistics. This chapter contributes to a growing literature base that appreciates the lived experiences of racially minoritised students in higher education, and our boundary is within STEM degrees, where students from minoritised ethnic backgrounds are seemingly better represented.

Our project is based at an English university with a student composition that broadly reflects the national population. The project received ethical approval to carry out the project by the university’s ethics committee and began in Autumn 2018 with a call for participants in any STEM undergraduate degrees, with an emphasis on those who consider themselves to be from a minoritised ethnic background. Using our own contacts as well as department websites, we set out to recruit UK-domiciled undergraduates from minoritised ethnic backgrounds. We approached over 100 staff to seek permission and support to promote recruitment; the promotion included over 60 short presentations to students about the project at the beginning or end of a subject lecture. Further details were disseminated through students’ virtual learning environment. Data was collected over three years and a small number of students continued with us over the course of the project, providing longitudinal qualitative data, which we explore separately.

We draw on semi-structured interviews conducted with 42 undergraduate students from minoritised ethnic backgrounds. Most students self-identified as women ( $n = 32$ ), but a range of racially

minoritised groups were recruited, including Black, East Asian, Middle Eastern, Mixed, South Asian and White European. Although our target was UK-domiciled undergraduate students from minoritised ethnic backgrounds, we also accepted interest and participation from those who self-identified as White British ( $n = 15$ ), which provided us with comparison data. Given that the scope and focus of this chapter is the experiences of racially minoritised students, any comparison with White British students would be inappropriate. Therefore, they are excluded in this chapter.

For context, the degrees that our students studied include biological science, biomedical science, computer science, mathematics, pharmacy and psychological science. We have chosen to extend our definition of STEM to include ‘non-traditional’ disciplines that involve scientific inquiry and positivist approaches to scientific knowledge. Whilst students’ experiences are inevitably nuanced and context-dependent, a closer examination of the views of marginalised students in different STEM (and non-STEM) contexts can highlight the persistence of racism and intersectional inequalities across university settings, as well as within disciplines.

For instance, disciplinary hierarchies can also exist within STEM fields (Wong, Chiu et al., 2023). They can affect the belonging of racially minoritised students, as well as students with other marginalised and intersecting social identities, as the white, male (able-bodied, cis-hetero) majority is overrepresented in the physical sciences, which are stereotypically elitist compared to the life sciences, which tend to be more diverse and in which minoritised students and staff are better represented.

The interviews lasted an hour on average; students were asked questions about their experience in higher education. Students were invited to share their experiences of and stories about race and racism in higher education, in domains which included accommodation, teaching and learning content and practices, and the study/university environment. The interviews were audio-recorded and transcribed verbatim, with sensitive details removed. For confidentiality purposes, data was anonymised and participants were given pseudonyms.

For the reader’s information, the authors all have a social science background with no associations or interactions with participants outside of the project. We are ethnically diverse, with heritages including British East Asian, White British and Middle Eastern. At the time of data collection, Wong was an academic staff member with a departmental role that championed equality, diversity and inclusion, Copsey-Blake was completing an undergraduate degree and went on to do a master’s, and El Morally was a doctoral student.

Data analysis was informed by a social constructionist perspective, which understands social phenomena as socially constructed and discursively produced (Burr, 2003). Interview transcripts were imported into NVivo, a qualitative data analysis software package, for initial data arrangement; we created provisional codes as we moved back and forth between the data and analyses in an iterative process, through which the dimensions of concepts and themes were refined or expanded as we compared the data (Corbin & Strauss, 2014). A coding framework was developed with a guided list of definitions for each code, and discussed between the team members. Each author independently coded five interview transcripts by relevant themes; we compared and reflected on these as a team, and debated any differences on the application of codes until a consensus was reached. We also wrote summary reflections about each interview and overall reflections on our experiences of working on the project. In the 'Findings' section below, we focus on the challenges of racially minoritised students as they navigate unwelcoming environments, deal with social exclusion and marginalisation, and cope with the many difficulties related to a lack of diversities and 'people like me' in STEM higher education.

## Findings

### Unwelcoming environments

As a result of racism, racially minoritised students in STEM have had experiences of feeling unwelcome in university settings and learning environments, especially in the form of racial microaggressions and racial stereotypes, and different levels of marginalisation. When subjected to racist remarks, most students, such as Pakiza (South Asian woman, studying psychology), opt to 'laugh it off at the time, but then it just sort of niggles at the back of your head ... that wasn't funny ... it was kind of scary'. Although some students said they were already accustomed to racially charged comments or questions from strangers in public, Pakiza said that similar experiences have happened at university, especially in student halls of residence, which have made her more aware of racial differences when interacting with White British students.

The embeddedness of institutional racism in the UK was described by Shanika (Black woman, biomedical science), who expressed a low sense of belonging and a general disconnect with unwelcoming environments, in university settings and in society more broadly. She said, 'A lot of people [are] naive [because they] don't understand Britain

[is] built on racism.’ She added, ‘It makes me feel uncomfortable that I live here. ... I can’t believe that this is sort of the place I live.’ Mabel (Black woman, biomedical science) suggested her peers were ignorant of and oblivious to the damage caused by racial microaggression, which she attributed to a lack of education about Black British history. She said:

People that do these microaggressions, they don’t understand why it’s so offensive. ... I think a lot of it is to do – because of Black history in schools. ... No one really knows about the Black British pioneers, what happened here, and not just to the Black British people but other ethnicities too who were also prejudiced against when they came here.

Unwelcoming environments have affected how racially minoritised students engage with their STEM degrees and learning environments. For instance, Lutih (South Asian man, psychology) observed that students of similar Asian background are ‘more likely to stay in’ and isolate themselves from groups to avoid negative interactions with their peers and others. Others, particularly Black students, suggested that racialised stereotypes and stereotype threat can cause marginalisation in academic settings (Gillborn, 2018).

In the same way, Tamu (Black woman, psychology) suggested that, because of racialised stereotypes, she has to be mindful of how she interacts with white students, as her tone and use of language can be ridiculed or policed by her classmates. She explained:

Sometimes, in terms of communication, there comes a clash in understanding how people communicate. People from my background are considered loud, harsh and rude. For us, we don’t see that as being loud, we’re just very expressive. ... There are some things that you should be mindful of how you say it. I learned that a lot from my British friend because she will tell me, ‘Oh, no, you don’t say that to someone.’ That’s a challenge as well.

Similarly, Carol (Black woman, biomedical science) recalled her limited engagement with a lecturer who ‘had given me zero for something that I’d actually done correct, so I emailed her to complain about that and she never replied’. Carol did not pursue the matter because ‘I didn’t want to escalate the issue ... [and] I kind of don’t want to be the one to cause trouble, so I guess that’s why I kind of just left it’. Here, her reluctance

reflects a fear of being labelled, and perhaps stereotyped, as troublesome, even when the act against her was unjust. For Black students such as Carol, these instances are often racialised, with negative consequences for well-being, attainment, and even safety. Cecilia (Black woman, pharmacy) described the harm that is caused by racial stereotypes, particularly for Black women like herself (Crenshaw, 1989), who are particularly underrepresented in STEM disciplines. She said:

It's just sad. You take into account, firstly, matters like Black Lives Matter. And for some people, it's kind of a performative stunt to just be like, 'Oh yeah, Black Lives Matter'. And then next thing you know, they're back to their normal lives. But for some people, it's a daily struggle. ... Narratives that are shaped by media or narratives that are perpetuated by certain groups of individuals, like the 'angry black woman', they are very harmful because at the end of the day, you are having to make yourself kind of inferior at hands of other people.

Students sometimes spoke of their 'incompatibility' with the popular, dominant student lifestyle and culture in the UK, which typically involves alcohol. Whilst not a concern specific to racially minoritised students in STEM, it is certainly a prominent issue that can exclude students and contribute to unwelcoming university environments across academic and non-academic contexts (see also Voice, Purdy, Labrosse & Heath, [Chapter 3](#) in this volume). Many of our students said they avoided societies or activities, as the popular drinking culture does not match their cultural or religious values and principles. Thus, very few students in our study were current or active members of university clubs or societies, thereby increasing their sense of exclusion and isolation, which can affect their overall sense of belonging in STEM higher education.

As Ying (East Asian woman, pharmacy) said, 'Most of them, they like to go clubbing ... [but] the way we have our amusement time can be go to cinema, watch a movie, shopping, travel and karaoke.' Students who chose not to engage in the dominant, partying culture described feelings of isolation from and loneliness within the white majority who lived with them or nearby. The problems include incidents such as disruptive social gatherings, and excessive noise during exam periods or at unsocial hours; these often result in confrontation, racial insults and alienation. More generally, our data suggests that student accommodation plays a role in building student belonging and the formation of friendships at university, especially for first-year campus students.

In short, the perpetuation of whiteness within university systems and cultures can create unwelcoming environments and affect the belonging of racially minoritised students in STEM. Therefore, it seems reasonable to suggest that, as a result of racial microaggression, racial stereotyping and dominant sociocultural norms, the university may be an unwelcoming, or even hostile, environment for students, including in STEM settings.

### Social exclusion and marginalisation

In addition to unwelcoming learning environments, challenges of underrepresentation, social exclusion and marginalisation create barriers to belonging for racially minoritised students. Tasu (South Asian woman, biological science) was critical of the university for not trying harder to ‘get everyone together’, especially those from diverse and minoritised backgrounds.

According to Andri (East Asian woman, mathematics), it is common to find ethnic groupings in lecture halls and classrooms, with racially similar groups often in their own clusters. While students like Shu (East Asian man, pharmacy) admitted that it is just easier to surround himself with ‘people like me’, especially those who understand his culture and home language, Disha (South Asian woman, mathematics) and others confessed, ‘I don’t have white friends’, and felt that her white peers ‘don’t want to be my friend because of my culture, maybe how I talk, maybe how I think’. Unfortunately, Disha’s concerns were sometimes reflected in our interviews with White British students (see [Wong, El Morally & Copsy-Blake, 2021](#)).

Some students said they made concerted efforts to broaden their social networks, but there were still challenges of acceptance by the white majority. Ying (East Asian woman, pharmacy) said she even tried to ‘adopt a British accent’ and therefore assimilate her ethnic and linguistic identity to fit in. Others, such as Chang (East Asian woman, pharmacy), described feeling like an outcast on her degree programme. She said, ‘I think a lot before I speak because I don’t want to offend anyone. ... Because I know that I’m a foreigner to them ... and I just feel like they are probably more comfortable with ... their own people.’

A lack of ‘people like me’ can thus lead to feelings of isolation and loneliness in STEM higher education, which tends to be pathologised in mainstream public discourse ([Davis & Ernst, 2019](#); see also Hyland, [Chapter 2](#) in this volume). The worry is that white students and staff are not able to recognise or empathise with the struggles and inequalities experienced by racially minoritised people. This has implications for



underrepresented students in STEM: a lack of understanding about racism amongst students and staff can trigger feelings of self-doubt and confusion, especially in racially minoritised students, through fear of invalidation or retribution, or of denial and rejection from the white majority (Davis & Ernst, 2019). For example, Sachini (South Asian woman, biological science) said:

Any time I walk in a room, I sort of try and not make direct contact with anyone. I don't know if they automatically just look at me because I look different, or whether you would automatically sort of look at anyone who would walk in a room.

Students also raised concerns that the teaching and learning in their degrees are rather homogeneous in terms of student and staff composition. Chang (East Asian woman, psychology) said that the limited visibilities of ethnically diverse peers and lecturers can be 'demoralising', as her cohort is predominantly White British. Furthermore, Tenner (Black man, biological science) felt that the lack of Black students in his course was unsettling, especially because of his fears of being stereotyped as the 'Black, ignorant [or] aggressive' man. Kevin's (Black man, biomedical science) awareness of racial stereotyping was shared by others, as mentioned earlier, and is likely to shape the belonging of minority ethnic, especially Black, students at university.

Relatedly, Alisha (East Asian woman, biomedical science) said, 'There are too many white students', while Chetachi (Black man, pharmacy) stressed, 'I barely see any Black staff', and explained that the lack of minority ethnic staff means fewer potential role models; this is important for students because 'you sort of identify with people who look more like you, because like, oh, they've made it, so you can make it'. Therefore, for students like Chetachi, the underrepresentation of Black people on the academic staff and the lack of role models can negatively affect their sense of belonging in STEM higher education.

Students also raised concerns about notions of coloniality and a lack of diverse perspectives within their STEM disciplines. For example, Kevin (Black man, biomedical science) expressed his discomfort about the continued exploitation of people in Africa, and the absence of global histories in scientific scholarship, contributing to the marginalisation of Black African students in STEM. He explained:

People from ... African backgrounds aren't reflected enough in research. ... A lot of the Western countries kind of go into African

countries and use people as [subjects of research]. ... I think that's the case with a lot of things really. I think you can generalise it to ... how, especially Britain got its power. ... We're not taught that it took advantage of people from other countries. We need to be taught about that ... to a wider extent, ... the history of science ... and empire. We're just taught that this person discovered this.

Similarly, Lutih (South Asian man, pharmacy) reflected that visibility was important on the STEM curriculum, as 'where you're from is where you relate to'. He continued, 'It's like if someone talked about your house or your home. ... If it's positive, you'll feel better. But, if it's negative, you'll feel really bad.' However, Disha (South Asian woman, mathematics) took an uncritical and value-free view of the STEM curriculum, and expressed her disinterest in diversity as, 'There's no pictures [in mathematics]. The books, they're just ... just mathematicians.' Mawiyah (Middle Eastern woman, mathematics) similarly expressed a positivist and objective mindset, and did not 'see how you can be diverse with maths. ... It's just numbers ... just theory.'

Therefore, social exclusion and marginalisation, including underrepresentation amongst student and staff populations, and an absence of critical and diverse perspectives on the STEM curriculum, can damage the belonging of racially minoritised students in STEM higher education. As we explain next, our findings also unveil the unique challenges associated with decolonising the STEM curriculum and countering objective approaches and ethnocentric assumptions about scientific knowledge in UK higher education.

## Discussion and conclusion

The evidence is growing on racial inequalities as experienced by students from minoritised ethnic backgrounds in UK higher education, notably in their degree outcomes. In this chapter, we have focused on student belonging, our emphasis being on the racialised aspects of students' experiences across university settings. Because of the nuances and shared underpinnings of racial experiences, there were occasional overlaps between our broad themes of *unwelcoming environments*, *social exclusion* and *marginalisation*. We recognise the fluidity and temporality of these social phenomena and experiences, as unwelcoming environments may lead to, or potentially worsen, social exclusion and marginalisation. Moreover, some racially minoritised students feel demoralised, isolated, lonely or ostracised because they are underrepresented in STEM higher education.

A lack of ‘people like me’, in both student and staff bodies, can exacerbate marginalisation and the perpetuation of whiteness in university settings, which in turn contribute to unwelcoming environments. We suggest that these barriers are a result of institutional racism, which is often overlooked in the existing scholarship on student belonging (Ahn & Davis, 2020). As discussed below, our findings are interpreted through the lens of CRT to contextualise the lived experiences of minority ethnic students. Here, we discuss implications for the widening participation agenda in the UK and make recommendations for policy and practice.

Racism and racial inequality in higher education often manifest as racial microaggression, racial stereotypes and social exclusion. Although racial incidents are complex and intersectional (Crenshaw, 1989; Gillborn, 2018), all instances of racism contribute to an unwelcoming environment (Ong et al., 2018). To rehearse a well-worn argument, more work is needed to eradicate racism (Bhopal, 2018). Staff and students must be aware and conscious of how existing practices can reinforce a racist climate for underrepresented groups, and this awareness and consciousness should be actively enforced and consistently reiterated in policy.

We recommend that awareness of racism and racist discourses is raised within higher education institutions, to ensure that reports of racism are heard and taken seriously, perpetrators are held to account, and those subjected to racism have access to appropriate support and care (Davis & Ernst, 2019). It is also important that universities encourage and platform collective resistance to racism and racial inequality, and do not restrict freedom of expression amongst racially minoritised students. Increased visibility of these issues would bring closer an environment in which racially minoritised students feel ‘seen’ and ‘heard’, not silenced and invisible (Wong, Copsey-Blake & El Morally, 2022).

Consistently with student-led campaigns and events to decolonise university curricula and improve minority ethnic representation on the academic staff (Peters, 2015), we also suggest that universities fully commit to the decolonisation agenda and encourage wider institutional discussion about what makes ‘good’ teaching, and how better to take into account the vast array of knowledges, experiences and talents of those whose ethnicities and backgrounds are marginalised (UCL, 2020). To support the decolonisation agenda in STEM higher education, we recommend that assumptions that Western scientific knowledge is universal, objective or value-free are challenged, and diverse perspectives and critical dialogue about the global implications and histories of STEM are platformed and encouraged. We believe these steps will facilitate a greater sense of belonging for racially minoritised students in STEM.

Many first-generation and underrepresented students struggle to align themselves with the university culture or expectations (e.g., [Ulriksen et al., 2017](#); [Wong, 2018](#)). Another noteworthy finding is the experience of Carol, who felt wronged by her tutor but refrained from seeking further details after her initial email was seemingly ignored. Whilst it is unknown whether the tutor consciously decided not to reply or it was a genuine oversight, Carol's reluctance to email again because of her fear of being seen as a troublemaker is telling, as she is conscious of how 'people like me' – a Black woman – can be negatively stereotyped ([Ong, 2005](#)). This fear was shared by Tenner, who was similarly afraid of being labelled as a 'Black, ignorant [or] aggressive man'. Consistently with CRT literature, racism is fluid and can change and adapt to different conditions and contexts ([Gillborn, 2018](#)). According to our understanding of racial and ethnic identity, Carol's sense of self as a Black university student appears to be under threat, as she thinks she must manage and navigate what she can and cannot do or say, in order to continue her STEM degree.

Whilst we are careful not to encourage messages of token diversity or interest convergence ([Bell, 1980](#)), a more inclusive institutional culture is likely to draw greater attention to the need to improve representation in the academic workforce and increase the number of visible role models. For example, a STEM 'wall of fame' could be presented across hallways, billboards and websites, along with stories of alumni and their pathways, with particular consideration and representations of minoritised ethnic groups and their contributions to STEM.

More generally, because of the renowned student nightlife, typically infused with alcohol, racially minoritised students appear less engaged with university clubs, societies and activities (including those which are STEM-specific). Perhaps these organised (social) events do not reflect the interest of students from minoritised ethnic backgrounds; if that is the case, concerted effort is required to broaden the range of student interest groups ([Miles & Benn, 2016](#)). Of course, we can easily say that racially minoritised students could take an active role in creating societies that are relevant to them, and some will have, but it is equally important for universities and their student unions to ensure that the university environment caters for diverse students.

Additionally, we recommend that staff take a more active role in encouraging students to engage with university support provision, including the well-being service and the process for dealing with extenuating-circumstances applications. We further suggest that universities actively encourage and create a safer and more robust

reporting system to encourage students to come forward. Such systems assist students to develop a sense of entitlement over their right not to be subjugated or victimised, and create an institutional culture that is based on mutual respect and recognition of diversity. This culture can be substantiated by institutional efforts that make expectations of students more transparent and explicit (Wong & Chiu, 2021), and reduce mismatch in expectations across and within STEM disciplines (Wong, Chiu et al., 2023).

In sum, this chapter has explored the barriers to belonging for racially minoritised undergraduate students across STEM disciplines. Consistently with CRT commentaries that assert that racism is embedded and ingrained in societal structures as a product of social thought and colonial imagination, our findings reflect the institutionalisation of racism and racial inequalities in higher education, as illustrated by our students across multiple university settings and STEM contexts. We conclude that, in order to reimagine the university as a place where belonging can be experienced by all students, institutions must commit to purposeful and meaningful change across departmental levels and contexts, as part of a broader, sustained and collective effort to eradicate racism and racial inequalities in higher education.

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