# The Student Experiences in STEM Report

Minority Ethnic Students in Higher Education

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# Acknowledgement

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# Foreword

"You can't be, what you can't see" is a phrase I heard when completing some leadership training a few years back. When I first heard this, it took me to place of reflection and fairly quickly, I was thinking about the importance of role models in my own life. Readers of this report will see that a key finding from the Student Experiences in Science, Technology, Engineering and Mathematics (SESTEM) project is the importance of role models and indeed moving towards "we can be, what we can see". In essence, we cannot undervalue the importance of representation and culture. At the worry of being reductionist however, the SESTEM project presents us with many other key recommendations.

Firstly though, the approach taken to explore the lived experiences of STEM minority ethnic students in higher education is one that resonates with the approach taken in the University's Race Equality Review (2021). In my view, we cannot make meaningful change without speaking to individuals who have experienced marginalisation. It is not for one to decide what will be helpful for others, but to truly listen, understand and act based on the lived experience of others. Indeed, this is an approach that I have taken in my own student experience research in the areas of LGBT+, neurodiversity and disability. In order to improve the student experience, we need to work with students. This may sound simplistic to some, but indeed, this is not currently the norm throughout the sector.

One key point to highlight is that the SESTEM project makes it very clear that racism exists. Once we acknowledge this, we can explore how individuals make sense of racism in today's society, the discourse surrounding racism, and the impact racism has on sense of belonging and identity in higher education. We can also explore the institution's role in eradicating racism and becoming an anti-racist University. In order to start this journey, the University's Race Equality Review

facilitated and actively encouraged conversations about race and racism. This step was very important as we first need to understand where we are now and what we need to do in the future to become an anti-racist institution. For example, educating ourselves is a powerful tool and one that should be supported by self-directed learning and attending training in allyship and anti-racism.

Within a Teaching & Learning lens, we need to take forward the recommendation to reduce the ethnicity awarding gap. As part of this journey, we need to decolonise curricula, which can sound quite daunting to some. In my view, we can deconstruct the terminology into a more accessible statement 'which voices have been heard and which voices have not been heard?' – representation is key here. As a reflective teacher myself, this is a process that I too am engaging in and the University is creating guidance to support staff in this area.

Throughout this report, readers will explore the above areas in more detail as well as reflect on the case studies of lived experiences. I personally found the case studies very powerful as they really cement the importance of making meaningful change for minority ethnic students in STEM.

I hope you find the report as useful as I did and remember – 'Diversity and Inclusion is everyone's responsibility'.

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# Executive summary

The SESTEM (Student Experiences in Science, Technology, Engineering and Mathematics) project emerged in response to concerns about the ethnicity awarding gap. Funded as a 3-year study by the University of Reading (2018-2021), the project aims to provide qualitative, longitudinal and contextualised data that will enable a better understanding of the experiences, opportunities, challenges and attainments of university students. We focus on the lived experiences of undergraduate students in STEM degrees, especially those who self-identify as from a minority ethnic background. The project sets out to gather empirical evidence to support the University's goal to reduce racial inequalities, including the ethnicity degree awarding gap. Over the three years, qualitative data was collected from students in the form of 88 in-depth semi-structured interviews, 155 termly journal reflections and two staff-student workshops. We also conducted a small-scale interview study with 20 STEM staff.

In the full report, the findings are presented in six sections, some of which are published in journal articles. We discuss how STEM students from minority and majority ethnic backgrounds make sense of racism in contemporary society, where we unveil three discourses as articulated by students, namely what we call *the naïve*, *the bystander* and *the victim* (Section 3.1). Our focus is then on the lived experiences of minority ethnic students, especially their sense of belonging and identity in higher education. Here, we discuss their coping strategies against racism through emotional desensitisation (Section 3.2). To make use of our longitudinal data, we summed up the challenges that minority ethnic students face at different stages, or levels, of their undergraduate degree, where we include three student case studies (Section 3.3). We also asked students to discuss the ethnicity degree awarding gap, probing into their awareness and understanding of the issues, which included attributions of individuals as well as

societal responsibilities and barriers (Section 3.4). We probed into their broader views and perspectives of the structural issues pertaining the education of STEM for underrepresented groups (Section 3.5), followed with a snapshot overview of the impact of the coronavirus pandemic (Section 3.6).

Based on the findings, including the staff-student workshops (Section 4) and the small-scale staff study (Section 5), we offer 12 recommendations, which are elaborated in the full report.

**Recommendation 1:** At the university level, it is critical that there is top-level commitment to acknowledge and address issues of racial inequality, irrespective of departments and disciplines. Such dedication should be public and transparent.

**Recommendation 2:** Institutions have a responsibility to eradicate racism. A zero-tolerance policy must be actively enforced and regularly revisited so that staff and students are aware and conscious of how existing practices can reinforce a hostile environment for underrepresented groups.

**Recommendation 3:** Our findings suggest more work is needed to dismantle a culture of silence with a proactive strategy that promotes the normality of verbal resistance against racist behaviours.

**Recommendation 4:** In particular, open discussions about race and racism would be essential to encourage more meaningful, realistic and reflective conversations about issues of race, ethnicity, diversity and inclusion at university.

**Recommendation 5:** We echo concerns over the lack of staff and student diversity, including visible role models for minority ethnic students, which continue to undermine students' sense of belonging at university.

**Recommendation 6:** Universities and staff may need to play a more active role to promote opportunities for social mixing.

**Recommendation 7:** Our students highlight the value of a diverse curriculum. The anticipation here is that with greater staff diversity, a wider range of values and perspectives will be incorporated into STEM teaching.

**Recommendation 8:** Universities are encouraged to consider the provision of greater economic support for minority ethnic students.

**Recommendation 9:** Staff and students will benefit from a structured programme of diversity and equality training or induction that is underpinned by the aim to tackle racism.

**Recommendation 10:** It is important that higher education staff have the time and space to reflect on their own privileges and biases as part of their personal and professional development.

**Recommendation 11:** We support calls for the establishment of a student committee, working group or network that focuses on race and ethnicity to appreciate the challenges and concerns of students.

**Recommendation 12:** We should focus on student empowerment and how universities ought to support minority ethnic students to capitalise on the different opportunities afforded by higher education. Expectations of students must be explicit and transparent, including what is desirable and rewarded, as well as what is undesirable and penalised.

# Contents

# 1. Introduction

The importance of Science, Technology, Engineering and Mathematics (STEM) to the economy and for the progression of society is widely acknowledged. Yet, in Western countries such as the UK, growing evidence indicates that the experiences and trajectories of minority ethnic students in STEM education are more challenging and difficult than their White counterparts.

The **SESTEM** (Student Experiences in Science, Technology, Engineering and Mathematics) project emerged in response to concerns about the ethnicity awarding gap. Funded as a 3-year study by the University of Reading (2018-2021), the project aims to provide qualitative, longitudinal and contextualised data that will enable a better understanding of the experiences, opportunities, challenges and attainments of university students. We focus on the lived experiences of undergraduate students in STEM degrees, especially those who self-consider as from Black, Asian and Minority Ethnic ('BAME'[1]) backgrounds. The project sets out to gather empirical and contextual evidence to support the University's goal to reduce racial inequalities, including the ethnicity degree awarding gap.

In the last few years, research attention on the experiences and outcomes of UK minority ethnic university students have gained momentum, especially those led by student unions (e.g., Bristol SU, 2017; Miller, 2016; SOAS SU, 2016; UUK/NUS, 2019). A rising number of universities also became member of AdvanceHe's Race Equality Charter (n=80, although only 17 award holders by September 2021), which indicates a greater public commitment to race equality.

Yet, there are persistent differences and increasing concerns over the differential degree outcomes between UK ethnic groups. In 2019, the proportion of white students graduating with a first or upper second-class degree (often known as a 'good' degree) is 81.4%, but this proportion falls to 58% amongst black African graduates, which equates to a 23.4%-point gap (AdvanceHE, 2020). More concerning, an 'unexplained gap' still exists even when students' prior attainment (e.g., A-level grades or UCAS entry points) is considered (UUK/NUS, 2019). Between White British and all UK ethnic minority students as a collective, the gap is still 13.3%. In short, UK ethnic minorities are less likely to graduate with a 'good' degree than their white British counterparts, even when prior attainment is considered (UUK/NUS, 2019).

A growing number of universities and/or their student unions are exploring this issue (see also Changing Mindset, 2018 at Portsmouth & partners; Dhanda, 2010 at Wolverhampton; Evans et al. 2018 at UCL; Miller, 2016 at Sheffield). At the University of Reading, the ethnicity differential degree outcome was 8.4% in 2019/20, down from 16.7% in 2016/7, although the gap is 16.2% between White and Black students (University of Reading, 2021).

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[1] We acknowledge that the acronym BAME is not an uncontested term. There are diverse and different experiences between minority ethnic groups and there is a danger that grouping all ethnicities under BAME neglects the specific challenges of particular ethnicities. In this report, we use the term minority ethnic students/staff, with more specific (but still broadish) groupings such as Black British, East Asian and South Asian when referencing particular individuals.

## 1.1 The study design

The SESTEM project was designed so that student participants would provide us with an autumn term written reflection, spring term semi-structured interview, summer term written reflection and an in-person discussion workshop with staff.

For students in their first or second year of study, we invited them to continue participating in our research, which allowed us to understand their experiences over a longer time period.

Over the course of the project, we collected 155 journal reflections and 88 in-depth interviews, with 57 unique students, of whom 42 were from minority ethnic backgrounds. We also conducted two workshops with over 40 STEM staff and students.

The Covid-19 pandemic arrived in the middle of the project, which did impact the breadth of data collection (especially the workshops), but it also provided us with a unique opportunity to document the impact it had on our students, from the initial UK national lockdown to their experiences one year on. Further details of the methodology can be found in the Appendix.
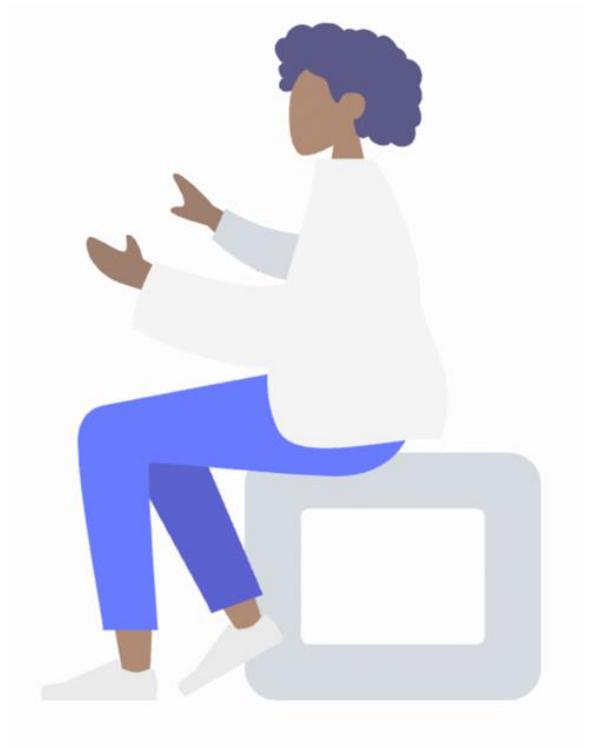
# 2. Ethnicity, higher education and STEM

This section provides a brief overview of existing literature and issues for minority ethnic students in STEM higher education. Around 23% of all UK-domiciled university students are identified as from a minority ethnic background, which converts to 24.9% in STEM and 16.5% in non-STEM undergraduate degrees (ECU, 2018).

Despite their better representation in STEM degrees, the metaphor of the 'leaky pipeline' has been used to describe the relationship between 'race'/ethnicity and STEM participation (AdvanceHE, 2020; Elias, Jones & McWhinnie, 2005). Students from minority ethnic backgrounds tend to gradually drop out of the STEM talent pool. Previous studies suggest that widespread images and discourses of science/scientists as typically for privileged white men can contribute towards the general lack of interest in science for students without these advertised characteristics, particularly minority ethnic students (Losh 2010; Ong, 2015). Yet, careers from STEM are often highly valued by minority ethnic families and viewed as a tool of social mobility in terms of attracting higher social status and earning potential (Wong, 2016).

Across UK higher education, there are growing concerns about differential degree outcomes – also known as the awarding or attainment gap. The ethnicity degree awarding gap, the term we adopt, refers to the difference in the proportion of White and Black, Asian and Minority Ethnic students awarded a 'good' degree (a first or upper-second class degree classification). Although the widening access to university agenda has made some progress in the ethnic diversity of the student body at many institutions, the more recent focus on student success and outcomes has highlighted a national difference of 13 percentage points in 2017/18 between 'good' degree

outcomes of White and Black, Asian and Minority Ethnic students (UUK/NUS, 2019). The ethnicity degree awarding gap varies significantly within minority ethnic groups, with the largest gap between White and Black Other students, at 28.3%, and the smallest difference between White and Chinese students (6.6%). Most worryingly, this gap exists even when controlled for prior attainment/entry grades (OfS, 2018). The degree awarding gap has implications for student entry into graduate-level jobs and post-graduate courses, as a 'good' degree is often the minimum requirement.

Until recently, including the resurgence of the #blacklivesmatter movement in 2020, public engagement with the inequalities of Black, Asian and Minority Ethnic people in the UK is arguably limited, despite evidence of disparity from health to housing to education (Bryne, Alexander, Khan, Nazroo, & Shankley, 2020). Although educational research on ethnic inequalities have been around since at least the 1980s (Troyna, 1987), this pool of research has stagnated, especially on post-compulsory education. Whilst there is research which has focused on 'race'/ethnicity (see Singh's review in 2009), considerably more studies have examined inequalities of social class and gender, including those with an intersectional perspective or with a broader focus on non-traditional students (e.g., Leathwood & Read, 2009; Reay, David, & Ball, 2005; Reay, Crozier, & Clayton, 2010; Wong, 2018; Wong & Chiu, 2019). In short, the university experiences of minority ethnic students merit further research, despite growing awareness, especially within UK higher education, of the structural and institutional inequalities as experienced by ethnic minorities (Arday & Mirza, 2018; Bunce, King, Saran, & Talib, 2019; Mahmud & Gagnon, 2020).

An increasing number of universities have advertised their commitment to diversifying and decolonising the curriculum, such as the *Why is my*

*Curriculum White?* at University College London, to tackle the whiteness that operates within the university curricula (Peters, 2015).  The movements to change the curriculum came as an afterthought to differential degree outcomes, as many argued that lack of representation within the course materials could be contributing to the increasing of the attainment and awarding gaps. There are wider concerns that as an institution, universities are racially biased, where White staff and students are the main beneficiaries and those from minority ethnic backgrounds often socially disadvantaged or marginalised (Museus, Nicholas, & Lambert, 2008; Yosso, Smith, Ceja, & Solorzano, 2009). Here, arguments of white privilege have been mooted (Bhopal, 2018), where being White entails inherent advantages in society. Bhopal (2018) explained that White privilege is fundamental to the structural apparatus and therefore affords undue benefits to the social hegemonic bloc and the majority White population, through 'the maintenance of power, resources, accolades and systems of support through formal and informal structures and procedures' (p. 19).

Here, we can relate to the lens of Critical Race Theory (CRT), which has gained momentum in race-related research in the West (Delgado and Stefancic 2017), including higher education research (Hiraldo 2010). The starting point for CRT is to recognise and accept that racism exists, with the aim to challenge dominant (and often, White) discourses that neglect or undermine the knowledge, value and skills of those from racial minority backgrounds (Bullock 2017). Solórzano and Yosso (2002) argued that a CRT approach would focus on the centricity of race and racism with other forms of subordination, including racialised stereotypes related to gender, socioeconomic background and sociocultural influences, and challenge dominant ideology that exposes deficit-informed research in the interest of maintaining white supremacy, and in turn, silencing or distorting the epistemologies of learners from diverse ethnic backgrounds (Yosso 2005).

Whilst other factors, such as gender and socioeconomic status, can also shape academic outcomes, minority ethnic students seem to undergo systemic inequalities that transcend other social identities. For example, Collins and Bilge's (2016) book, *Intersectionality*, highlights the realities of multiple and intersecting inequalities, especially on how these are manifested in different ways across social identities, such as gender and ethnicity, and for instance, the unique challenges of being a Black underprivileged woman (Crenshaw, 1991). Similarly, Rollock et al. (2014) also demonstrated racial differences in terms of social class privilege, through Black Caribbean middle-class parents, who must negotiate or utilise different strategies and resources to maximise their socioeconomic advantage to support their children's education. Here, ethnic minorities are disadvantaged by being ethnic and racial minorities, even if seemingly privileged in other ways, which would reflect a society that privileges individuals who are racially white.

While the literature highlights the existence of systemic inequalities, more research is merited to understand the lived experiences of minority ethnic students, especially in UK STEM higher education.

# 3. Findings

In this section, we present our findings in six sections. We begin with (3.1) how STEM students, from minority and majority ethnic backgrounds make sense of racism in contemporary society. We discuss three discourses as articulated by students, namely what we call *the naïve*, *the bystander* and *the victim*. Our focus is then on (3.2) the lived experiences of minority ethnic students, especially on their sense of belonging and identity in higher education. Here, we also discuss their coping strategies against racism through emotional desensitisation. To make use of our longitudinal data, we are able to sum up (3.3) the different challenges minority ethnic students face at different stages, or levels, of their undergraduate degree. We offer a thematic summary as well as case-study analyses of the trajectories of *Nancy*, *Carol* and *Mawiya*. We also asked students to discuss (3.4) the ethnicity degree awarding gap, probing into their awareness and understanding of the issue, and some of their suggestions are incorporated into our recommendations later. The next section (3.5) draws on the broader views and perspectives that students have on the structural issues pertaining the education of STEM for underrepresented groups, concluding with a snapshot review of the impact of the coronavirus pandemic (3.6).

## 3.1 Making sense of racism: the naïve, the bystander and the victim

From the data, we identified three prominent student discourses of racism, which we tentatively call the naïve, the bystander and the victim. These discourses of racism are not mutually exclusive, although most students seem to articulate their views of race and racism that map onto one of these discourses. We want to point out the surprising lack of engagement from our STEM students on issues of racial equality. There was little evidence to support a discourse of racism that might be labelled as *the protestor* or *the activist*. In other words, there appears to be a missing discourse in our study to account for students who protest, oppose and actively defend against racism. These students certainly exist, albeit in other disciplines, but perhaps not in the critical mass that is often needed for meaningful actions and preventive measures. Perhaps such a role is less relevant or promoted in STEM disciplines, given the context and content of these subjects are typically driven by 'hard facts' and 'objectivity' (Garibay, 2015). These are written up in our full paper (Wong et al., 2021).

### 3.1.1 The naïve

*The naïve* refers to those who do not believe issues of race and racism are relevant in contemporary society, especially in the UK. Here, racial inequality, prejudice and discrimination are considered to be lessons of history rather than an active or on-going concern. These students accept that racism existed, but only in the past, and are therefore unaware, or deny, that it is still a current issue for social justice. Students who articulated *the naïve* discourse of racism are mostly White British, although a few minority ethnic students also shared this viewpoint. A lack of awareness or acknowledgement of racial inequalities may reflect the rather homogenous social environment of the individual, especially if surrounding family and peer groups are culturally and ethnically similar.

Of particular concern here is that the denial and dismissal of racial inequality can contribute to a powerful discourse that removes or negates the existence of structural and social barriers and propels an egalitarian perspective that places all responsibilities of success and failure on the individual (van Dijk, 1992). When asked explicitly about racial inequalities, students who articulate the discourse of *the naïve* tend to say everyone is similar or that there are little differences between them, irrespective of ethnicity. Georgia (White British female), for example, told us that 'some of my best friends at school were Black and they were never treated any differently to me'. From her

perspective, typical of *the naïve*, students are all equal in that everyone is treated the same (rather than an equality of opportunity approach) and rejects that racial inequality is a current concern.

### 3.1.2  The bystander

The second student discourse of racism we identified is called *the bystander*, which includes descriptions that are typically associated with the roles of the observer, spectator or even *silent* witness. Students who articulated the discourse of *the bystander* seem to recognise and acknowledge the existence of racism and racial inequalities but are not readily prepared to interfere or interject. The general disposition of *the bystander* appears to follow the practice that one should not get involved in the business of others, especially since the issues of 'race'/ethnicity are often sensitive, complex and therefore best avoided.

For some, notably those from White British backgrounds, *the bystander* discourse seems to reflect their uncertainties about the *right way* to discuss or comment on racial issues or inequalities, with concerns about being politically incorrect, inaccurate or offensive. Their position as the ethnic majority, for instance, could mean that it is experientially difficult for them to empathise with the racial challenges as experienced by minority ethnic groups. For example, Abigail (White British female) said 'I don't know if it'd be my place to report it' if she witnessed racial incidents. As such, the discourse of *the bystander* seems to encourage a culture of silence, passivity and non-interference. Worse, as Bhopal (2018, p. 120) passionately argued, 'a failure to acknowledge racism results in a failure to act upon it', building on the popular saying, 'silence is complicity'.

Racism is not always obvious or explicit, which means there can be alternative interpretations as to whether an incident or issue is considered as racist, especially if there was 'no malicious intent' – whatever that may mean. Several students, including those from minority ethnic backgrounds,

recognise that everyday jokes and humour are sometimes taken too seriously and therefore do not merit interference. Paddy (British mixed female), for instance, said she is often asked 'where are you from?' more than once when her initial answer was not accepted. She said that these questions were 'not necessarily offensive but they're not nice [and] they're not a racial insult'. For Paddy, enquiries about her ancestral origins were interpreted to be from people who are curious, rather than with racist intent. Others have also played down incidents of possible racism as unfortunate misunderstandings of light-hearted jokes. Disha (British South Asian female), for example, acknowledged that some of her peers 'make fun of my accent [but] these are just for fun'. In other words, potential racism can be re-interpreted and experienced as jokes or banter. For further discussion, please refer to our paper (Wong et al., 2021).

### 3.1.3  The victim

The third discourse, *the victim*, refers to those have experienced racism or racial harassment and injustices. By victim, we do not mean weak or vulnerable, but someone who has been mistreated due to their 'race'/ethnicity, from microaggression, implicit and subtle racisms, to open and explicit forms of racial prejudice and discrimination (Bowling & Phillips, 2000). We note that the racialised discourse of *the victim* can overlap with *the bystander*, in the sense of feeling *silenced* and therefore unable to respond, react and report racial incidents. As such, the narratives we present are not experiences that are openly or casually shared by students, especially those from minority ethnic backgrounds. Relatedly, we did not find clear examples or narratives of students who adopted the role of an active *protestor* against racism, which further highlights the power, culture and prevalence of *silence*.

When asked to talk about racism in the context of their university experiences, several students, especially from minority ethnic backgrounds, spoke

of their *acceptance* of moderate racist behaviours and microaggressions as normal (see also section 3.2). For these students, the standard response is *not* to react or retaliate. Many prefer to ignore and move on, akin to *the bystander*, except these students are also *the victims* of racism. These experiences are not limited to the university, but the frequency at which these occur can certainly reinforce the status quo that such behaviours are common, normal and should even be tolerated.

For example, Shu (British East Asian male) said he had issues with his noisy flatmates, who partied weekly, in student accommodation. Eventually, there was a house meeting attended by the warden, but Shu said that 'none of us speak up about it … because I'm the only Asian … we tend not to take any action' and admitted his fears of retribution because 'my flatmates, I think it's seven of them, they formed a gang'. As such, Shu felt life would be easier if he could just accept and tolerate these apparent cultural differences to minimise his risk of being targeted within his own accommodation.

Another example is Kane (Black British male), who said he has already accepted that as a minority, 'you gotta work twice as hard for everything you do'. Kane was adamant that 'I've never used my background as an excuse because I know that if I sit around and sulk, then I'm not going to get anything in life … I've had certain incidents, but I've got past that'. Here, students like Kane are reluctant to embody an identity that resembles a victim, despite their articulation of such racialised discourses. We can see that victims of racism can also play down and deny, in the sense that individuals themselves refuse to attribute their negative experiences as a direct result of racism. Such a view also aligns with the discourse of *the naïve*, although here, the presence of racism is accepted but just not used as a justification for unequal outcomes.
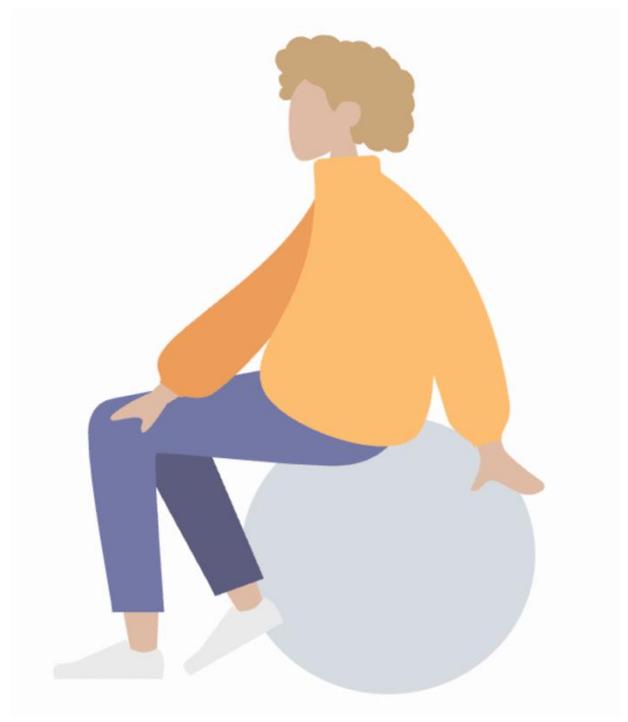
## 3.2 Sense of belonging, identity and responses to racism

The struggles of minority ethnic students in higher education are well documented within the broader research on 'non-traditional' students (Shiner & Noden, 2015; Wong & Chiu, 2019). These include concerns around transition, underachievement, retention and dropout, as well as the economic, social and cultural challenges for students who are unfamiliar with the higher education environment (Ulriksen, Madsen & Holmegaard, 2017). Minority ethnic students are presented with a range of challenges that can dampen their sense of belonging and identity in higher education. As racial minorities, students can often be the one odd out. Andri (East Asian female), for instance, struggled to find commonality and 'people like me' within her academic community because, in her words, 'I am the only Asian one here', which made her feel 'out of place' and therefore less invested in the social or community aspects of university life. Data in this section contribute to two papers currently under review.

### 3.2.1 The environment

In and out of university, our minority ethnic students have experienced different levels of hostility and discrimination, from verbal abuse from members of the public to microaggressions from peers and housemates. Although the perpetrators may be unaware of their actions, and genuinely unintentional, these actions have emotional consequences. Minority ethnic students, especially females, have spoken of their incompatibility with the popular student lifestyle and culture in the UK, which tend to involve alcohol. Whilst not a concern specific to minorities, it is certainly a prominent issue that can segregate students. Many of our students admitted to social distancing from societies or activities that are perceived to be fused with alcohol, including sports clubs (more specifically their social events). As such, very few minority ethnic students in our study are current or active

members of university clubs or societies. Our students described finding it difficult to fit in, as the drinking culture does not match up to their cultural or religious values and principles. A relative lack of non-drinking societies and extra-curricular activities has meant that it was challenging for many of our students to meet others, make friends and build social networks with people with different interests. As Ying (British East Asian female) bemoaned, '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'.

Our data also suggests that student accommodation plays an important role in building a sense of belonging at university, especially for first year campus students and the formation of friendships (Harwood, Huntt, Mendenhall, & Lewis, 2012). Some students said they were unable to live and experience a full campus life due to differences in cultural values, especially those from families with more traditional views. For most others, this was a welcomed opportunity to meet people, socialise in new environments, learn about different cultures and find freedom away from home, all the while living a short distance from their lecture theatres and minutes from the social buzz of the entertainment facilities on campus and the city centre. Our data suggest that while White British students were most positive about their living arrangements, the experiences of minority ethnic students were more mixed.

### 3.2.2 A clustering of 'people like me'

Unsurprisingly, the abovementioned challenges have influenced the social networks of minority ethnic students, as many struggled to establish diverse peer groups outside of their own ethnicities. Katherine (Black British female) reckoned that ethnic minorities flock together because 'we'll understand each other' better, although Tasu (British South Asian female) was more critical of the university for not trying harder to 'get everyone together', irrespective of their

backgrounds. Thus, the formation of ethnic enclaves constitutes a gravitational pull of 'students like me' together. According to Andri (East Asian female), it is common to find ethnic groupings and segregations in lecture halls and classrooms, with racially similar groups often in their own clusters. While students like Shu (East Asian male) admitted that it is just easier to surround himself with people like him, especially those who understands his culture and home language, Disha (British South Asian female) and others confessed that '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. As an illustrative example, Rachel (White British female) admitted she avoids conversations with minority ethnic students because she assumed they would speak differently and she 'won't be able to understand their accent'. Disha also admitted her struggles to 'get into conversations' due to a lack of knowledge or interest in British cultures. Rachel similarly described an 'air of silence' in lectures, where she felt minority ethnic students are more reluctant to contribute or integrate having established their friendship groups or cliques, potentially worsening social exclusions of students who do not 'fit in' with the majority group. Here, Nancy (British East Asian female) admitted that most of her friends were from minority ethnic backgrounds and felt that her White peers 'share different values' and are sometimes 'ignorant' of other cultures. Although some students said they made concerted efforts to broaden their social networks, there were still challenges of acceptance by others into their peer groups. Ying (British East Asian female) said she even tried to 'adopt a British accent' to fit in. In short, minority ethnic students seem to experience struggles when establishing relationships with peers outside of their broad ethnicities.

### 3.2.3 Standing out in the 'wrong' way

Our minority ethnic students have also raised concerns that the teaching of and learning in their degrees are rather homogenous in terms of staff and student composition, as well as the breadth of the curriculum. Chang (British East Asian female) conceded that the limited visibilities of 'people like me' from staff or fellow students can be demoralising, as her degree is predominantly White. The worry is that White students and staff are not able to empathise or even recognise with the struggles and racial inequalities as experienced by minority ethnic students. Furthermore, Kevin (Black British male) admitted that the lack of minority ethnic students in his course is unsettling, especially fears of being stereotyped as the 'black, ignorant [or] aggressive' male student. Indeed, Alisha (British East Asian female) said there are 'too many white students', while Chetachi (Black British male) stressed that 'I barely see any Black staff' and explained the lack of minority ethnic staff means fewer potential role models, which is important for minorities because 'you sort of identify with people who look more like you, because like, oh, they've made it, so you can make it. And I don't feel like that'. As such, for students like Chetachi, the lack of diversity has negatively shaped their sense of belonging in higher education.

Consistent with existing literature (Ladson-Billings, 1998; Peters, 2015), our students recognise and are mildly alarmed that their degree curriculums are currently too white and Anglocentric, with limited reference to or examples of scholarly contributions from other parts of the worlds. Again, this lack of diversity means it may be harder for minority ethnic students to associate or relate the content of these learnings to their own contexts. There are, however, pockets of counterviewpoints that argued STEM are founded on objectivity and therefore the content (at least) is just a reflection of its history, rather than a deliberate negligence of other contributions (Miller, 2007).

### 3.2.4 Emotional detachment and desensitisation

Consciously or not, most minority ethnic students in our study seemed passive and even resigned in the battle against racism. Perhaps the consequence of previous (or continuous) negative experiences to challenge or call out racist behaviours, there appears to be a tone of acceptance about the unequal playing fields for underrepresented groups, especially racial minorities. When our students recalled and reflected episodes of their discriminatory experiences, most appear to trivialise their racial mistreatments and instead reframed those incidents as unintentional misunderstandings rather than malicious acts.

For those who have experienced explicit racism, most often through verbal abuses such as 'go back to your own country' from members of the public, as in the case of Alisha (British East Asian female) and several others, their reactions are usually to ignore and avoid engagement with the perpetrator (especially strangers). Alisha reasoned that it would be an unnecessary confrontation with little to gain but many risks, particularly personal safety. For students such as Tenner (Black British male), racially-motivated verbal remarks are often disregarded because of the frequency it occurs and therefore not worthy of their time or energy to react. Tenner said he has learnt to focus on what matters to him and refuses to allow racism to define his wellbeing and future experiences. Here, students appear to have developed a level of immunity against reacting to racialised comments. In other words, there is a degree of tolerance amongst minority ethnic students towards their own experiences of racism, especially encounters that are seemingly implicit and verbal. Some played down the significance of their experiences and dismissed the idea of being racial victims. Minority ethnic students appear to be emotionally detached and even desensitised from everyday racism.

Emotional distance and delayed emotions or reactions appear to be adopted by some students as a mechanism to cope with or interpret racism. Whilst Pakiza (British South Asian female) said her appearance is often subject to racists jokes from friends 'whenever there was a terrorist attack or something', she would typically 'laugh it off at the time' alongside her peers, although she admitted 'then it just sort of niggles at the back of your head [later] and I was just like that wasn't funny'. Here, Pakiza's default response is to play along, subconsciously, with a racialised discourse, even if the content is racially aggressive towards her, but only to reflect and react later about the implications and meanings of these narratives. Similar to research on Black men in the US who experienced 'racial battle fatigue' (Smith, Hung & Franklin, 2011), Kelly (British mixed female) was conscious about how she reacts to racists comments and admitted that 'I have to sort of hold my tongue sometimes when people say things… I can't intervene every time someone says something that's slightly racist'. She is worried about being 'the one who makes a thing about race' and accepts that 'I can't fight every battle'. Here, Kelly opted for a more strategic and collegial approach in how she engages and reacts to racially-sensitive topics with her White peers.

When probed, most of our students suggested that confronting racists and reporting racism would be their last resort, rather than their first response. The reasons as to why minority ethnic students appear reluctant to report racism are multifaceted, including fears of retribution and the difficulty in proving less explicit forms of racism. Of more concern is the apparent lack of trust and confidence from students in racial reporting, including the university's grievance process. Chetachi (Black British male), for instance, was sceptical as to what actions might be taken in response to racial complaints. He asked, 'what are they [the university] going to do? They probably will just warn the student, just give them a warning rather than do anything serious'. As such, Chetachi believes racial victims would avoid the reporting process because of the belief that 'the university wouldn't do too much'. Here, students felt there is a lack of communication, from the basic acknowledgement of the concerns raised to the actions, if any, that would be taken

as a result of the complaint. As such, widely-held perceptions, as well as actual first-hand experiences of, low transparency and progress do little to help promote or restore confidence in the grievance system.

### 3.2.5 The search for solidarity, support and solace

Beyond the strategy of emotional detachment to tolerate racism, minority ethnic students appear to find strength and solidarity from fellow minorities to improve their experiences and sense of belonging at university, despite everyday racism. Here, we highlight the importance of strong friendship groups and staff role models.

It should not be surprising that most students gravitate towards 'people like me' and form social groups and networks that might resemble the establishment of ethnic enclaves. While some students stressed that they have proactively socialised with their White British peers, most admitted that these friendships were largely superficial and fragile. Aside from differences in personal interests and values (e.g., alcohol-related activities), which can happen in any friendship, minority ethnic students felt few of their White peers appear to be able to empathise with their experiences of being an ethnic minority, especially as regular recipients of racial mistreatment and microaggression. As such, most students said they found it easier to build friendship with people who are also ethnic minorities themselves. Ali (British South Asian male), for example, admitted that he does not have many White friends but explained that:

> *At the end of the day when it comes to what we relate to, what we can joke about and what our experience is, it will always be someone of like an ethnic [minority] background. It wouldn't even just be like brown, I have Black friends and East Asians or African, Arabs, and everyone is like, because we relate more.*

Like many others, Ali found support and solace from fellow minority ethnic students, even from different cultural and racial backgrounds. These peers, at the very least, share the common experience of being an ethnic minority, which seems to be sufficient for students such as Ali to strengthen their sense of belonging at university. In a related vein, Carol (Black British female) said that 'I don't know why, but on my course I know every ethnic minority, and we all sit together', whilst their white peers are in their own groups. This segregation of student groups, especially by perceived race or ethnicity, is not an uncommon sight in higher education (Chen & Ross, 2015).

Although students value the presence of minority ethnic staff as potential role models and advocates who strive to improve the experiences of ethnic minority students, the ways in which staff (from any backgrounds) interact with students are also considered to be central in how students develop a sense of belonging, especially in feeling valued and acknowledged. Tamu (Black British female) explained that she felt insignificant and 'like a number' after she struggled to secure meetings with her personal tutor, who has too many students. In other words, Tamu and others like her were metaphorically lost in a sea of students. Instead, a little encouragement from staff can go a long way, as in the case of Hannah (British mixed female) who recalled her surprise and delight when a lecturer praised her and remembered her name (see Wong, 2018 on the 'ripple effect'). For staff, it may be a simple and normal aspect of their teaching, but for students such as Hannah, this basic act of recognition appears to have strengthened their sense of belonging. As can be seen, minority ethnic students appear to have found solidarity, support and solace from minority ethnic peers and supportive staff, especially those from minority ethnic backgrounds

*Case study 1: Nancy the Pragmatic*

Nancy is a British East Asian female who studies computer science, a technology degree with a history of male and masculine stereotypes. She chose computer science because she considered it to have potential and mileage in terms of future financial returns and career prospects. Popular in East Asian families, Nancy admitted that her parents were influential in her educational pathway, with the good intention to ensure that her choices are 'right'. For higher education, this meant a degree with a clearer and safer future career pathway (Wong, 2016). Although Nancy was passionate about English literature, she believed job opportunities in the arts and humanities, as well as the social sciences, would be less when compared to STEM graduates (DeWitt, Archer, & Moote, 2019).

In the first-year, Nancy said she initially struggled with a sense of belonging and felt very isolated. She did not find friends who shared her values and interests. She said, 'I have found it quite difficult to get accustomed to university life... I found that in terms of accommodation, people can be much more difficult to deal with than expected'. Her social struggle prompted Nancy to question her degree choice and she even considered dropping out or changing course, although she was worried about how her parents might react and so, she persevered. However, she experienced and witnessed casual racism and racial microaggression, often from peers in and around her student accommodation and social circle. Nancy recalled being shouted 'a Chinese bitch' by intoxicated flatmates who 'banged on my door at 2am', being mocked for her appearance and unfairly accused as a supporter of dog meat consumption. Reflecting on her first-year, Nancy said she 'learnt how and when to keep quiet even when I have been wronged', highlighting her personal growth but also increasing tolerance of racial injustice.

In the second-year, Nancy's social life improved as she established a closer friendship group, who just happened to be mostly students from minority ethnic backgrounds, despite her insistence that it was not deliberate. However, halfway into her degree, the coronavirus pandemic arrived. People perceived to be of East Asian origins, including Nancy, were subject to heightened levels of racially-motivated abuse (UK Parliament, 2020), from verbal attacks in the wider public to microaggression from fellow peers. For example, Nancy recalled at the beginning of one lecture, 'they were playing this coronavirus song today... on the main computer screen... but it was sung in a very stereotypical Chinese accent. And I just didn't find it funny'. Although Nancy was unsure if this act was directed at her, she 'just turned it off' and admitted that 'it did kind of irritate me'. The perpetrators may have done it for fun, as a joke, but oftentimes these so-called banters can embed racist and/or sexist undertone and undermine the sense of belonging and identity of underrepresented groups.

In the third-year, Nancy opted to do a year-long work placement, which was confined to working from home. After securing her offer, Nancy recalled a dismissive comment from a male peer who downplayed her success by adding that 'you're able to find a placement quite easy because you're a girl'. Another male student also joked to Nancy that girls can use their 'feminine charms to get answers... [or preferable treatments] in the workspace and stuff'. According to Nancy, some 'people actually see it [being a female] more as an advantage' because the tech sector is seemingly on a mission to increase diversity, especially on more women. This aim may be well-intended, but there are unintended consequences. The accomplishments of females can be challenged by others, which can manifest into self-doubt. Indeed, her taste of the profession seems to have shaken her development of a professional identity in STEM, which is unfortunate as Nancy is academically competent. Yet, academic grades alone do not seem to provide Nancy with the confidence or validation of her skills and competencies in computer science. Nancy is due to return to university for her final year and from we have learnt about her experiences and trajectories, she is unlikely to stay in STEM, at least in the foreseeable future as her engagement in STEM was predominately pragmatic.

## 3.3 The STEM undergraduate journey

In this section, we offer a summary of our thematic analysis into the key issues for minority ethnic students in each year of undergraduate study, reflecting on the start, middle and end of the STEM degree journey, which are typically three years in England. We also include three case-study style vignettes to highlight the experiences and trajectories of minority ethnic females.

### 3.3.1 Year 1: Transitional challenges

Starting university is a big change for most students, especially ethnic minorities who may experience additional challenges due to racism and racial inequality (Arday & Mirza, 2018). Like most first-year students, our minority ethnic students found the transition into higher education to be overwhelming, stressful and confusing. Many noted a steep learning curve to be independent, with greater individual freedom but also responsibility, including their approach to finance and study as they navigate and develop their STEM student identity (Briggs, Clark & Hall, 2012). Unlike schools, which are typically more structured, our students quickly realised the onus of their degree education is very much on them, such as lecture attendance, seminar/lab participation and reading preparation. Students can choose how to engage with their academic study. As Kevin (Black British male) commented, 'it is now completely down to you, no-one will question if you do not attend lectures or certain seminars or are not studying on a particular day'.

Adapting to self-directed or autonomous learning is a common challenge for many first-year STEM students (Holmegaard, Madsen, & Ulriksen, 2014). Tamu (Black British female) explained that the 'whole support system' is different because 'university is so much bigger than school'. There seems to be census on the belief that STEM students ought to be proactive learners, which, according to most of our students, are outside their comfort zones. More concerning, there is

speculation that much of what is expected of students is rarely, if ever, explicitly explained or communicated by tutors. In other words, expectations of students appear to be implicit and implied (Ulriksen, 2009; Wong & Chiu, 2020, 2021a). An evidential consequence of this is their common struggle to fully utilise the available support, from staff to professional services, as a result of their reluctance or unfamiliarity to be proactive and ask for help (Wong & Chiu, 2019).

There were, of course, positive experiences in the first-year as students embraced their new social and learning environments. Yet, many admitted an initial struggle with the difference in academic expectations and the in/direct consequences of *always* being in the minority, especially in their programme of study and social surroundings.

### 3.3.2 Year 2: Finding balance

Whilst students found first-year courses can sometimes include content already covered in schools, the second-year is often described as a massive step up, both academically and socially. Many admitted falling behind in their learning preparations and a growing number found it more difficult to balance and manage the pressures of increased workload and deadlines, which is not helpful as their grades will now count towards their final degree outcome. According to Alisha (British East Asian female), 'the autumn term was very busy. There was a lot more lectures in a week compared to last year and there was an unknown cause of stress right from day one… I was a bit lost... it was a hard term'. Second-year students are normally expected to have settled into their study, including accommodation and finance issues. Yet, our students signalled the continued challenge with maintaining balance, especially between academic and social life.

For students such as Paddy (British mixed female), the second-year also marked the end of their participation in social and extracurricular activities, with academic study taking precedence, which for some include searching and preparing for work

placements or internships. An increasing number of degrees, including in STEM, now encourage or expect students to seek work experience before graduation, from a few weeks to a whole year (Gbadamosi et al., 2019). Some programmes now have work experiences embedded as part of the degree, whilst others would offer the option of year-long industrial placements (e.g., a *sandwich* degree, which are more typical in the social sciences, see Jones, Green, & Higson, 2017). Although students will be supported in these applications, they must first actively seek for these opportunities themselves, which can be paid or unpaid. Only a handful of our minority ethnic students sought STEM-related work experience, predominately in the second-year. Most students opted out of their optional placements, reportedly overwhelmed by existing commitment or felt unprepared and unable to afford or apply for these opportunities (which are often poorly, if at all, paid). Instead, our students seemed to prefer doing more accessible work in the catering or retail sectors for the main purpose of making money.

As with the previous year, students said they gradually adapted to the pace and expectations of the second-year, despite fluctuating levels of anxieties at the beginning.

### 3.3.3 Year 3: Staying positive, managing differences and living with racial injustices

The third-year, and for most, also the final-year, is often an intensive period as students juggle between the pressures of completing their study and planning for post-degree options and careers. Preparing for the next step can be daunting and demoralising, especially if their efforts or applications were unsuccessful, which can undermine aspirations and confidence. Ehab (British Middle Eastern male), for instance, admitted to having no concrete plans after he graduates. He has started job applications, but without success thus far, he is now worried about 'losing motivation… if I continue to be rejected'.

Navigating between final-year study and securing a post-degree pathway demands resilience, perseverance and optimism as students battle to stay positive despite setbacks. In the final-year, students also reflected on their entire undergraduate experience and most were generally positive about their personal and academic development. A typical reflection is from Tasu (British South Asian female), who said:

> *I believe I have become more independent and more mature... I have learned to prioritise my tasks and better manage my time and not drive myself into too much pressure and stress. I have become more self-aware and am more open to feedback than I used to be.*

Compared to the start of university, students acknowledged their improvements and progress over the years. Shu (British East Asian male), for example, said he has gradually developed confidence to participate in peer discussions, 'I have slightly changed my study behaviour… I try to be more proactive in the group discussion. I have developed my social skills as I can [now] communicate people with different ethnic backgrounds'. In the first-year, Shu's social circle was ethnically homogeneous. By the final year, he can, at last, feel more comfortable to interact socially with peers from different cultures. Overall, our students felt that their academic skills have improved each year. More importantly, some students have also sought support as and when needed, with recognitions that asking for help is an acquired skill and a sign of a self-awareness, rather than an indication of weakness.

*Case study 2: Carol the Persistent*

Carol identifies herself as a Black British female and began participation in our study as a second-year student. She studies biomedical sciences, which was a backup option as she was unsuccessful in her bid to do a degree in medicine. To her credit, she persevered and by the end of her undergraduate degree, Carol was accepted onto a postgraduate programme that provides a pathway into the medical profession.

Carol describes herself as active and adventurous, constantly 'trying new things… meeting new people', akin to a social butterfly. However, she said she struggled to find friendship in her first-year student accommodation, where her flatmates were mostly White British. Despite 'making the effort', she found 'they were a bit passive aggressive and a bit cold' and concluded that her flatmates 'were a little bit closed minded… about somebody outside of their own culture'. Nonetheless, Carol persevered and thrived socially as she found solace in the wider student community from diverse backgrounds. Her conscious and active identity management highlights the challenges she experiences to maintain an intelligible and intellectual STEM identity.

Carol shared an episode of her interaction with a member of staff during her second-year that can illustrate her precarious identity in STEM (see example of Mawiya as well). In a section of an assignment, Carol was graded a zero, which baffled her because she thought 'it was something that I actually done correct'. Carol said she emailed her tutor 'to complain about that and she just never replied'. However frustrated, because Carol 'didn't want to escalate the issue', she let go of the issue and explained that 'I kind of don't want to be the one to cause trouble'. Here, her consciousness of not wanting to be seen as a potential troublemaker may reflect wider and often negative stereotypes about Black females (Ferguson & Martin-Dunlop, 2021; McGee & Bentley, 2017). Although Carol said her encounters of racism, sexism and microaggressions are limited at university and if anything, often trivial (e.g., 'making fun of my hair'), she did say 'I may be a bit oblivious… to these things' because she was raised to be self-assured in that 'if I tried my best that's all that really matters…[and] if I do badly, I just need to try a bit better'. Here, Carol appears persistent and seems to have developed a level of tolerance against different setbacks, including implicit racism. However, on the above episode, she felt wronged and powerless. The silver lining is that the zero grade had limited impact on her overall outcome.

Reflecting on her undergraduate study, Carol said she has, through trial and error, 'devised techniques to retain large amounts of information within a short space of time', which significantly boosted her confidence going forward. She believes she has become 'more resilient' and 'more confident', and remains positive that she is 'equipped with the skills I need to handle' issues of racism and sexism in the future.

## 3.4 Student views about the ethnicity degree awarding gap

Most of our students were unaware, and a few were surprised to learn about a gap in degree outcome by ethnicity when we used the national figure in interviews as a prompt to initiate a discussion about the ethnicity degree awarding gap. We asked students to reflect and comment on the degree outcome differences, including possible reasons as to why such gap exists. Given STEM disciplines are often presumed to be more objective, differences in student comprehension and attainment could easily be regarded as a mere reflection of individual aptitude, although as discussed already, minoritised students are often subjected to more social barriers than others. This finding in this section is part of a published paper (Wong, ElMorally, & Copsey-Blake, 2021).

### 3.4.1 Individual difference and aptitude

Through the lens of meritocracy, educational success and failure would reflect individual effort, ability and merit. The degree awarding gap, in the context of ethnicity or other social characteristics, is considered by some students to be normal, natural and nothing extraordinary because there ought to be differences in aptitude between individuals. Highly competent students are rightfully rewarded with high grades whilst less competent students would receive grades reflective of their comprehension in their respective degree discipline.

Most of our White students expressed an individualised perspective on degree outcome differences but struggled, when probed, to articulate their thoughts on why an ethnicity degree awarding gap exists. Most responses here were short and vague, with 'don't know' or 'no comment' the popular comments, which may also hint a level of unease or unawareness of the issue. Mandy (White British female) speculated weakness in academic study skills and said that 'grammar might

be an issue which is picked up quite a lot and just like misunderstanding', whilst Rachel (White British female) speculated poor social integration might explain why minority ethnic students end up with lower academic grade.

Some minority ethnic students were also unsure in their responses and seemed reluctant to place any blame on others for their academic attainment, and thus, opted to take full responsibility themselves if their degree outcomes were poor. As Nancy (British East Asian female) said, 'I think it's really down to the individuals' as she offered examples of her minority ethnic flatmates who appeared unmotivated to attend lectures, even though Nancy anticipated students with immigrant parents (who are most likely also ethnic minorities) 'be more hardworking… cos their parents usually really push them'.

Meritocratic ideals, which celebrate individual agency, may empower students to believe that educational outcomes are fair reflections of their aptitude. Yet, as discussed below, our students also recognised that such perspectives can dangerously hide and neglect the invisible but active disadvantages that operate at the structural level.

### 3.4.2 Social barriers and structural challenges

Our students also identified a range of social and structural barriers that could explain the ethnicity degree awarding gap. Although these views were mostly articulated by minority ethnic students, some were recognised by White British students, especially those who have studied sociology or learned about social inequalities in school. Melony (White British female), for example, recalled that 'in Sociology, we learned a lot about different groups of people and how it affects education, and it was typically ethnic minorities who have poor[er]… quality of education', which is linked to family and financial resources but also wider racial inequalities.

Unpacking the possible reasons for the ethnicity awarding gap, a popular view from our students is the perception that UK minority ethnic people often stem 'from a slightly disadvantaged financial background [so] they're just going to be disadvantaged at some stage' (Mawiya, British Middle Eastern female). Others have suspected that minority ethnic students may be poorly prepared for higher education, being unfamiliar or found it difficult to 'fit in' with university cultures and expectations (Reay, Crozier, & Clayton, 2010). In addition to resource disadvantage, our students also recognised broader structural challenges, especially racism (see 3.2), as a key factor in understanding ethnicity degree outcome inequalities. Racial mistreatment and microaggression, often in subtle and implicit forms, can be detrimental to minority ethnic students and their sense of belonging at university.

An interesting theme that also emerged was a perceived language barrier, with the emphasis on those with a non-English speaking home environment. The ethnicity degree awarding gap might therefore reflect the challenges that some students experience when assessed in English, especially in disciplines that also use technical terminologies. According to Rebeka (White European female), 'science is really hard, you have to know a lot of terms and specific terms and you have to be okay with the English [words]'. Similar comments were made by Kevin (Black British male), who concluded that the language of science can be exclusive and inaccessible.

Whilst competence in academic English may impact grades, some students, especially White British, also seem to have conflated minority ethnic students with international students, who are imagined having weaker academic English. Yet, the concerning statistics on the ethnicity degree awarding gap is for UK-domiciled students, which can be baffling since most Black, Asian and mixed ethnicity students achieved above the national averages prior to university (DfE, 2019). Following this logic, either the language used in higher education is drastically different to schools in a way that disproportionately disadvantages ethnic

minorities, or that language is not a key barrier as some envisaged.

*Case study 3: Mawiya the Precarious*

Mawiya is a British Middle Eastern female who studies mathematics. According to Mawiya, she is 'the only person wearing a hijab', which makes her rather conscious of her appearance in large settings such as lectures. Interestingly, Mawiya does not believe her university experiences are negatively affected by her ethnicity or gender, although she admitted that 'I rarely think about these issues' (see section 3.1.1). For Mawiya, mathematics is an intriguing subject because it 'actually makes sense to me' and she found it 'really easy' in school. She continued mathematics at university because 'I don't know what else I wanna do' but she recognised that a mathematics degree will provide her with broad career options.

As with others (e.g., Nancy and Carol), Mawiya struggled in the first-year to find commonality with her White British flatmates due to their incessant drinking, partying and late-night activities and noises. As the year progressed, Mawiya formed friendship with other minority ethnic females, because 'we have a lot of things in common' (see 3.2.2). Academically, Mawiya started positively with first-class grades. However, in the second-year, she struggled with motivation and confidence, recalling that 'from the first day of term, I felt very overwhelmed and even though I wasn't, I felt very behind'. Her anxieties grew and she 'couldn't focus on studying and I started falling behind'. Whilst tutor support was available, Mawiya admitted she 'never emailed or asked question outside of tutorials [because] I'm too anxious to ask', which meant her struggles were unattended.

In her third-year, Mawiya undertook a yearlong industrial placement and worked in a healthcare company as a statistician. Her role involves data monitoring and statistical analysis, which was 'very relevant to my degree'. Mawiya was initially full of praise because she 'really enjoyed' the work experience and the breadth of skills she was developing. However, she later reflected that 'the more I think about it, I feel like the more negative I think of it', which seems to have fed into her precarious identity in mathematics. Here, Mawiya experienced self-doubt and questioned her own skills and abilities. As she confessed. 'I feel like I'm not progressing and not even meeting expectations… It's just feels like everyone else is sitting there concentrating and actually able to do some work and again, I am not'. Whilst her peers, who completed a similar work experience, shared their joys and satisfactions, Mawiya asked, 'why am I the only one who is feeling really shit about this?'.

Her struggle with motivation continued into the fourth- and final-year. Alongside on/off lockdown rules and social distancing due to the coronavirus pandemic, Mawiya found online learning difficult to engage, which added to her mental stress and anxiety. She even lowered her expectations and reassured herself that 'all right, let's just aim for a 2:2 (lower second-class)', which is another band lower than her second-year grades. More worryingly, her identity in mathematics appears fragile as Mawiya contemplated retaking the year, or taking a year out, 'possibly travelling and still working somewhere'. She remains uncertain of her career pathway and admitted that 'I haven't even really figured out… honestly it's all in the air now'. Overall, Mawiya's higher education has been a journey of self-learning and development. Her identity in mathematics started off strongly, reaffirmed by high grades, but she struggled in subsequent years and began to self-doubt her ability. She often felt underprepared and overwhelmed, which impacted her motivation and had materialised into lower outcomes. Her work experience was valuable, but her observation of others, and their apparent competency, have also undermined her self-efficacy and weakened her STEM identity (Carlone & Johnson, 2007).

## 3.5 Unconscious group and affinity biases

Even though racism and discrimination based on race are socially unacceptable and, in some cases, punishable by law, carriers of the racist beliefs have remained vigilant in the way they disseminate within society. This is evidenced by the noticeable negligence of some White students we spoke to towards racial issues. Contrastingly, minority ethnic students have stressed the centricity of ethnic background in their lived experiences. Not only did we find that students from minority ethnic backgrounds feel 'out of place', as mentioned earlier (see section 3.2), but we also found these students to have internalised their respective positions within the society. For instance, White British students are less likely to notice or comment on issues of ethnic diversity when compared to minority ethnic students.

From a more holistic perspective, we argue that the intersection of race with affinity bias (i.e., the unconscious tendency to gravitate towards 'people like me') can explain the discrepancies observed. On race-related issues, some of our White students appeared disinterested and aloof, indicative of a lack of awareness towards privilege of their race. A few were even defiant and reacted less favourably when discussing ideas such as 'affirmative action' or 'positive action'. This in turn changed the tone of conversation from investigative to defensive. Students who reacted in said manner showed a basic understanding of 'White guilt' and 'White shame' to defend their position. Unaware of the inherent contradictions of White guilt and shame, these students seem exposed the side-effects of affinity bias; the familiarity of their race appeared to prevent their ability to realise their biases. However, when such biases are left unchallenged, the bias self-actualises, and any action to prove its validity is used as confirmation (i.e., 'confirmation bias').

On the other hand, minority ethnic students and allies alike, are often aware of the dichotomous environment. However, when one is unconscious of

social hierarchies, it is easier to submit to it and, in some cases, reproduce and perpetuate it. This model is theorised as the 'stereotype threat' (Osborne, 2001), in which a person feels at risk of confirming to an existing negative stereotype about their affinity group. When the 'vulnerability', e.g., assumed to be 'weak' because one is an ethnic minority, is reiterated to the student, their performance is undermined and their focus shifts to negating the negative stereotype as opposed to completing the task, compromising the integrity of the results. This means that in situations where the salience of one's stereotyped group-identity are increased, so is one's vulnerability to the stereotype threat.

The issues above can coincide with students' academic performance, contributing to the ethnicity degree awarding gap (see section 3.4). We must therefore review and restructure the training and development schemes for students and staff that would accommodate for unconscious bias and its effects on students.

### 3.5.1 Racism and sexism in the broader STEM context

In STEM degrees, the environment is mostly dominated by White men, which can breed microaggressions with a racialised and gendered undertone. Microaggression can also manifest itself in terms of gender or racial discrimination. Melony, a White British female, for example, discussed the gender role division in the STEM workplace:

> *I think, obviously you hear comments like sexist comments. When I was at work, one of the managers was saying, we have to go and lift something and they're always like, we'll get the boys together, lift it. The girls were always made to waitress, not be seeing out of the front, whereas the boys do the room service and things like that. There's still like a pay gap and things.*

We also explored institutional biases and their effects on student experience and performance in

STEM. We looked at how the lack of symbolic and substantive representation may affect learning. We speculate that an internalised sense of superiority and inferiority exists amongst the students we interviewed.

For example, Chetachi, a Black British male, felt that these negative stereotypes are not susceptible to change due to the lack of existing role models for Black students. Describing his experiences, Chetachi shared:

" *I barely see any black staff. There's only one in [my department], and sometimes I ask myself, 'How does he feel being the only black person in the whole building full of maybe Europeans and whites? How would you feel?'*

He continued to add there is a lack of role models for Black students to guide and substantially tip the scales in favour of ethnic minorities. Respectively, Katherine, a Black British female, touched upon the double-burden of being an ethnic minority and a woman, stating:

These accounts highlight that an intersectional approach to race, ethnicity and gender at the university level is needed to counteract the effects of historic marginalisation and break the socialised inferiority-superiority cycle. We stress that a glass ceiling does seem to exist for minority ethnic students, which puts a barrier to entry and achievement. This ceiling is comprised of internalised emotions and unconscious biases towards the *othered*, as well as the *double-burden* of the stereotype threat that can negatively affect minority ethnic female students the most.

## 3.6 Covid 19 - The coronavirus pandemic

As the coronavirus pandemic arrived in the middle of our study, just as we were carrying out the interviews with students in the second year of the project (March 2020), we included a few additional questions in our data collection to appreciate the impact of Covid-19 on their education. We continued with these Covid-related questions in our termly reflections and the final year of the study. Here, we offer a snapshot analysis of the impact of the pandemic for our students, which draws on the extra questions in the termly reflections in May-June 2020, completed by 24 students (and 22 from minority ethnic backgrounds). The additional questions were:

1. What concerns do you have about the impact of Covid-19 on your degree or study?

2. What changes did your department/schools and tutors made in response to Covid-19 and what do you think about these changes? What was done well and what could be improved?

3. What do you think about the move towards online teaching and assessment? (e.g., what do you think about the systems of the 'safety net' and the 'no questions' request for extensions?)

4. Do you have any other comments specifically related to Covid-19 and your university education? (e.g., were there accommodation issues? Financial issues?)

As a rapid analysis, the summaries of student responses are presented as bullet points, with selected illustrative quotes to promote the voices of students.

### 3.6.1 Concerns due to Covid-19

- Challenges of studying at home, with other distractions and limited study space. This was particularly the case for international students who need time to readjust to a study mode whilst at home.

> *It impacted my study as I am only able to study in a library environment. Covid made me study in my own home which wasn't ideal for my revision as I can never focus and always get distracted.*

- Challenges of maintaining concentration and motivation.

> *I'm concerned that I won't be able to achieve the 1st that I've been working so hard for. In first and second year I averaged 77%, but since lectures have been moved online and lockdown enforced my motivation has dropped to an all-time low, due to a combination of factors such as decline in mental health.*

- Concerns of limited interactions with peers and engagement in social events.

> *This may be trivial, but I am worried that my uni experience would be changed due to Covid causing lectures to be online – I won't be able to hang out with my uni friends/ flatmates but hopefully Covid doesn't delay lectures too much for 2nd year.*

- Concerns about poorer performance due to anxieties.

> *I normally find myself only being able to properly study or research or work on my coursework in an environment like the library.*

> *Being surrounded by other students who are doing the same thing in a quiet atmosphere is most ideal for me... Though my environment at home is not negative in any way, it has been extremely difficult to focus and stick to my usual routines, so I know I have not put in my best effort with my final pieces of work. I am only concerned that this will reflect on my final grades.*

- Uncertainties on the extended use of online teaching, which limits face-to-face interactions.

- Concerns about how exams are marked, given it is open book and unsure if expectations would be higher as a result.

- Concerns about the lack of job opportunities after graduation.

- Concerns about work experience in the next academic year, especially those with a work placement year ahead.

- Challenges of limited/no access to the library and laboratories, including university computers, especially for power demanding software.

### 3.6.2 The response of departments

- Students were generally appreciative of the responses by their department and the university in light of Covid-19.

- Online lectures and online interactive tutorials (Q&A), including one-to-one tutorials, are useful and appreciated.

*Academic tutors were very proactive in meeting and ensuring we were doing okay which really helped feeling supported and taken care of. They ensured we had enough opportunity to discuss changes to summative assessments and were very understanding of the different circumstances for everyone making art which made all the difference and helped embrace the situation and working with what we had. Tutorials were moved online, so there was a lot of effort to maintain contact and teaching which was really appreciated.*

- Some praised the proactiveness of staff to promote/facilitate online discussions and support.

- Most appreciated the increased communications with their tutors, although some thought there was too much, whilst others too little or lacked details, from departments and the university on 'what next'.

*The personal tutor has asked details about where we are, whom we are with, making sure that we are safe. This was very much appreciated. The university has sent regular e-mails, updating us on every new measure and decision… I am overall happy with how the university responded to this situation.*

- On improvement, some suggested there could be more interactive quiz/task, as well as longer breaks between exams.

### 3.6.3 Thoughts on online teaching /assessment

- The move to online teaching and assessment were generally well-received as students recognise alternative options were limited.

*We can watch recorded videos at our own pace and make noted at our own pace as well. I personally liked having online classes.*

*The move to online teaching was good and efficient – something that could occur more during normal term time as it saves a lot of time, not having to travel in.*

- Most felt the shift to online teaching is fair and useful, including take-home exams, rather than an 'all pass' approach – as this makes their study more worthwhile and reflective of the learning that took place.

- Most appreciated the 'no contest' Extenuating Circumstances Form (ECF) request system.

- Some praised the 'safety net', even if it did not benefit them students personally, although others felt the 'net' could be more universally relevant as the criteria limited the applicability.

*I'm disappointed in the Safety Net as for me, it only applied to one 20 credit module which didn't have a summer exam anyway. I don't think it was a suitable solution for the majority of STEM subjects, which tend to have more exams, and a better solution could have been to*

*ensure all students who have already got above 40% average can't get lower than this."*

- Most online exams were positively experienced, but a few felt their exams could be better thought out in response to the 24-hour time-window format. Online exams also promoted a different approach to assessment – akin to coursework where there is more time to construct the 'best' version.

"*I am extremely grateful for the 23 hours available to access and submit exams as there have been instances at home in which I would have been unable to complete an exam within the standard 2 hours. I thought the online teaching was okay, in fact, I felt as though I were in a more relaxed environment at home as opposed to sitting in a lecture theatre uncomfortably for 2 hours.*
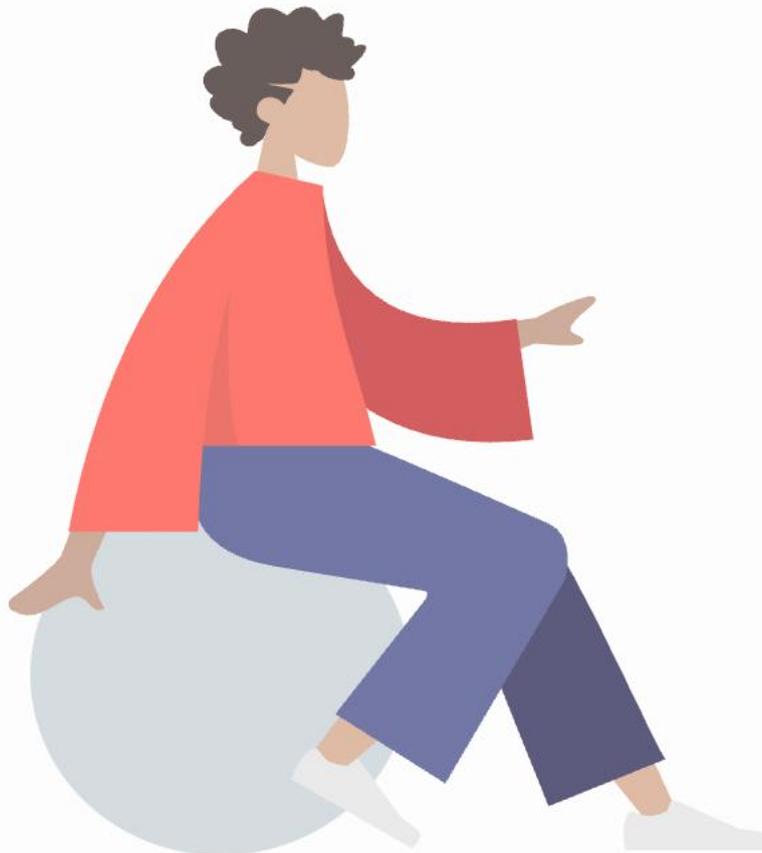
# 4. The staff-student workshops

We ran two half-day workshops in Summer 2019 with the aim to explore the views and suggestions of STEM staff and students on the experiences and outcomes of minority ethnic students in STEM degrees. The initial plan was to hold yearly workshops, with subsequent summers to discuss emerging findings from the project. However, workshops in 2020 and 2021 were cancelled due to the coronavirus pandemic.

Three broad questions formed the foundations of our two workshops in 2019, attended by 27 students, 12 staff and three student union officers. Participants were arranged in groups that included at least one staff and students across different programmes. Each question was discussed for 30 minutes, with ideas written and noted on a large A1 paper, where each group shared/presented to the rest of the audience for 3 minutes at the end.

1. What do we currently do to support students in our programmes?

2. What challenges/barriers do you think students from minority ethnic backgrounds experience at university?

3. What should be our next steps?

## 4.1 Existing student support

Our participants acknowledge there are various facets of student support, including the well-being services, the Disability Advisory Service (DAS), and student support centres and coordinators. However, when probed, students themselves had little experience in accessing these provisions. The breadth of information given to first-year students was considered as important but potentially overwhelming, especially for those who may struggle to absorb or recall the range of support presented to them. There were also

concerns that these services are perhaps not as well advertised as they could be, with the consensus being that students were generally unaware of the specialised support provisions which are provided by the university.

Drawing on academic support, and with consideration of the optional support available, students listed Peer-Assisted Learning (PAL), maths and study advice, and English language support as the most useful. However, there was arguably a greater appreciation for academic support which is embedded in students' degree programmes, especially timetabled sessions that appear to be a part of scheduled learning, rather than optional choice and additional help, especially for revision, professional development, and study skills.

While students agreed that academic tutors were a 'source of knowledge', some were perceived as intimidating, and less approachable, supportive or generous with their time than others. Some lecturers were also said to redirect students elsewhere, or to papers, books or other resources, when they asked questions or contacted them after lectures, although this seemed to vary depending on how students felt they were perceived.
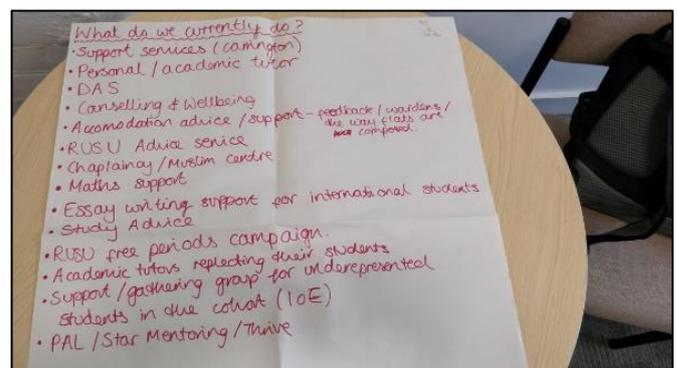
## 4.2 Challenges and barriers for minority ethnic students

Participants were probed to think and reflect on the challenges and barriers for minority ethnic students. Issues around cultural differences and the difficulty of cultural integration were most frequently raised. Participants felt strongly that religious practices, such as Ramadan (including the related challenges to study and revision), as well as celebrations and holidays, are often overlooked by fellow staff and students. At times, there was a conflation between minority ethnic students and international students. For example, there was a recognition that international and exchange students may experience more difficulties in finding a sense of belonging at university, possibly due to homesickness. Participants also reflected on language barriers and the related accessibility of university support systems. Some lecturers were said to fail to account for speed or language, notably through the use of idioms and jargon, which can be potentially exclusive and detrimental to students' participation and attainment.

The underrepresentation of minority ethnic students and staff was noticed, from senior levels of leadership to those in positions of support, including academic tutors and mentors, as well as student course and halls representatives. There were concerns that some staff or support providers, particularly older generations, are less empathetic of the current expectations of students, or aware of their own biases and ways of viewing the world. The issue of the STEM curriculum was also raised, as it was generally perceived as 'too white' and lacking in diversity, although seemingly objective and therefore challenging to diversify and decolonise. Additionally, a lack of minority ethnic role models was said to shape how students identify with STEM disciplines and careers.

There is also the possibility of cultural stigma that may deter some minority ethnic students from accessing support, such as feelings of 'shame' associated with counselling and wellbeing, or not wanting to ask questions in lectures or tutorials.

Language barriers may prove challenging if students are not appropriately supported to communicate their needs effectively. Minority ethnic students felt that their struggles during university were generally unrecognised, with nobody there to check up on them. They suggested it was therefore easy to 'fall into a pit and not leave your room', which only toughens the challenge of catching up and seeking help.
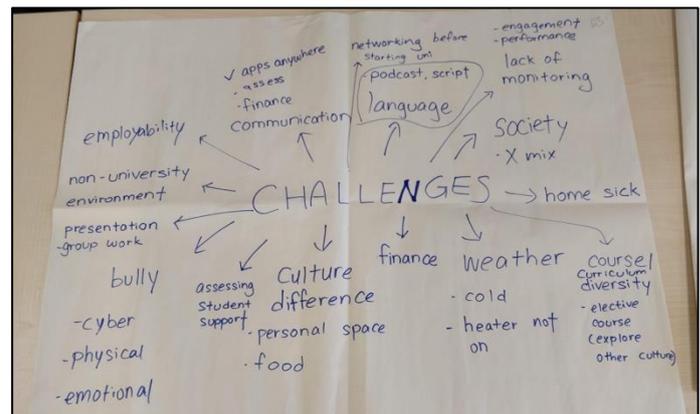


## 4.3 Next steps

Drawing on the next steps, a range of ideas were discussed. There was a particular focus on induction and fresher weeks, which might be improved to better equip students with an awareness of ethnic diversity within the university, as well as the knowledge and understanding to target inequalities. For example, induction teams might consider incorporating a compulsory lecture for all freshers on anti-racism and cultural sensitivity. The design of Fresher's week could also be explored by Reading University Student Union (RUSU) to include a wider range of provisions and activities for minority ethnic students, by shifting away from solely alcohol-oriented social events and being more inclusive of the interests and cultures of the diverse student body. Given the overload of information around student support during Fresher's Week, it is also important that these details are rehearsed again via an accessible website that is user-friendly, which might be explored by a working group with students as co-developers. Participants also suggested the possibility of a 'Refreshers' event at the start of Spring term.

To target issues around the underrepresentation of minority ethnic students and staff, it was noted that the university should not only endeavour to diversify its population, but provide staff with appropriate training and support on diverse and inclusive pedagogy. To reduce perceptions of bias, all coursework, where feasible, should also be done through anonymous marking via Turnitin. A discussion of the overall lack of cultural sensitivity also led to suggestions of more teaching materials online, which potentially go beyond slides and extend to podcasts, or even scripts or notes of the lecture. We suggest increased conversation with other STEM departments and universities may be productive, although the support of heads of departments and programme directors is critical for any meaningful progress. To increase representation of minority ethnic role models, participants also explored *quick win* ideas, such as a 'wall of fame' in hallways or billboards for stories of minority ethnic alumni and their pathways, and to highlight a more diverse range of knowledges and contributions to STEM.

Participants also reflected on the effectiveness of student-led networks and societies on improving feelings of belonging, such as those led by RUSU, including the Afro-Caribbean Society, as well as on-campus religious centres such as the Chaplaincy and Muslim Centre. It was suggested that societies could meet collectively to promote integration between students from different backgrounds, as well as to improve observance and appreciation of diverse cultures and religions. Another suggestion entailed a 'vertical' student peer support group within programmes and departments, where later years (postgraduates) support earlier years (undergraduates) by sharing their experiences and advice. This might be weighted by a recognition system as an incentive to increase participation, either in the form of a certificate or paid employment. Participants also raised the idea of a 'buddying' or 'peer in the year' system to improve the transition process, although we acknowledge that this approach needs to be piloted and better understood to mitigate the potential dangers of social and ethnic mixing before it can be implemented.

Others suggested that they would benefit from wider institutional discussions about extending support services to students who must navigate race and ethnic related challenges and inequalities. For example, participants highlighted the potential value of specific minority ethnic and/or international mentoring programmes and provisions, including language and interpretation support. It was agreed that an internal evaluation of the student welfare service is needed, especially on their capacity and availability due to high demands, as well as the extent current support systems are working for students from different backgrounds and circumstances, including Extenuating Circumstances Forms (ECFs), Special Educational Needs (SEN), the DAS, language support, and study skills or preparation at university. Finally, it was noted that teaching staff should take a more active role in improving students' awareness of the support available to them, who might be encouraged and reminded through regular contact with university student support coordinators and services. For example, lecturers should regularly remind students of information about wellbeing and ECFs at the beginning of lectures, so students are able to revisit the slides and hear how to access the multiple support provisions that are provided by the university throughout the year.
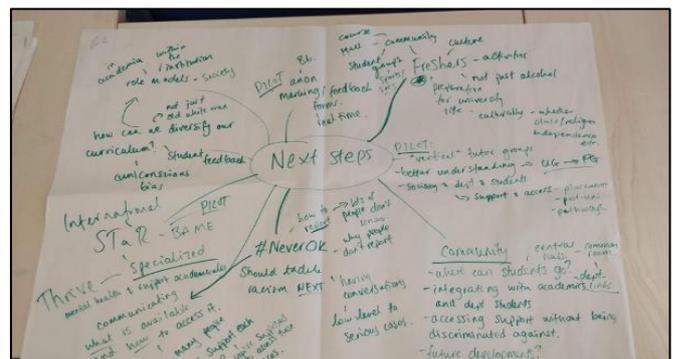
# 5. A case-study of STEM staff

As part of the SESTEM project, we also created a small-scale study that focuses on the views of STEM staff, as a summer project in 2019 through the University's UROP (Undergraduate Research Opportunities Placement) scheme. We recruited Layan Kawas, a second-year mathematics undergraduate, who worked with us for 6-weeks to focus on the experiences of lecturers as we attempt to garner a more holistic understanding of the challenges and opportunities for STEM staff to promote diversity and inclusion in their roles as lecturers.

A total of 20 staff from STEM disciplines took part in our semi-structured interviews, which included questions about their views and experiences about diversity and inclusion, as well as issues related to teaching pedagogy, curriculum design and the ethnicity degree awarding gap. In order to maintain anonymity, interviewees are addressed by number (i.e., Staff 1 to Staff 20), with limited reference to their specific STEM discipline, unless the context of the discussion merits a mention. We recognise that our staff participants are most likely those who are invested in the issues of our research. For context, 13 of the 20 participants were male, with seven females. For ethnicity, 14 self-identified as White British, European or a mixed White background, with six participants considered themselves as from a minority ethnic background. Participants were lecturers or professors in a range of STEM disciplines including biology, chemistry, computer science, construction, mathematics, meteorology, and pharmacy. A separate report was written up, available here, as we provide a concise version below.

## 5.1 Staff views about the ethnicity degree awarding gap

STEM educators were asked for their thoughts on the ethnicity degree awarding gap, including why they think it exists. The most popular response was that of role models. Staff have highlighted that many STEM departments are predominantly occupied by white middle-aged men, with one or few minority ethnic students or staff:

*Well we certainly have 'BAME' staff, but it is true that we are a predominantly white department. White and male as well, so the lack of visible role models within the staff body is unquestionably a challenge…It's very difficult to be what you can't see. (Staff 1)*

Some staff acknowledge the ethnicity degree awarding gap may reflect how universities operate, others believed that there are reasons external to the university. For example, a few staff said that student's socioeconomic background was the most important factor influencing attainment. That is, those that come from a higher socioeconomic background are more likely to succeed and given minority ethnic students are less likely, in general, to come from a high social class background, the difference in degree outcome is to be expected.

Similarly, there are staff who pointed out that perhaps a higher proportion of minority ethnic students are also commuter students, which may have negatively impacted their experiences and outcomes, although this view was speculative and not evidenced. Prior education was also brought up by few staff. Discussion on the ethnicity degree awarding gap was, for many staff, a rather sensitive topic. Some were unaware of such a gap, whilst others offered social and individual issues as possible factors. Yet, we noted that those who responded with uncertainty or no knowledge of the gap were very open to hear possible reasons and future improvements to address this outcome inequality.

## 5.2 The STEM Curriculum

Educators were also asked if they believe their STEM curriculum was 'too white'. One mathematics staff said that although the content may not directly be too white, the presentation of it certainly is. They pointed out that the majority of faculty at the university was educated in Europe and probably by white, middle-aged male educators. This inevitably may lead to themselves educating their students in a similar manner which may favour or reflect white male values. A few other staff also recognise that in their respective STEM disciplines, educators rarely talk about the history of it and the different cultural contributions from around the world, but that these disciplines may indeed present itself with a heavy European-centric and American point of view.

Another mathematics staff, however, argued that it is very difficult for mathematics to be too white due its numerical nature. Here, mathematics is 'just numbers' and assigning a race or ethnicity to numbers does not seems logical, 'I mean, math is a subject where it's just numbers and stuff, you know? It's not like some subjects which have a social, political aspect to them' (Staff 13).

Here, we note a chemistry educator who believed that the subject does not lend itself to issues of diversity, especially when referring to reaction names, which were often named after European scientists that may add an aspect of whiteness into the discipline. Similarly, a computer science staff pointed out that the curriculum itself may not be too white, but they accepted that aspects of it may look as though it favours white people. For example, when developing software for facial recognition in America the software often ends up being better at recognising white faces. This may be due to the fact than when testing and developing the software, White faces were normalised.

## 5.3 Diversifying teaching and learning

Staff were asked if and how they might incorporate diversity into their teaching, which, as hinted above, can vary by discipline. Pharmacy staff, for example, seem to find the inclusion of more diverse content and authors easier than staff in mathematics or chemistry. For example, in mathematics, the history of differential equations is rarely, if ever discussed. The educator's goal is to give students the knowledge required to solve mathematics questions, which means, with limited time, there is no capacity to deviate from existing content to consider the culture or history of these equations.

There were concerted efforts by some staff, which may provide examples for others. Some staff mentioned that they would like to show students that scientists are not just 'men in white coats who are white'. To this end, they believed that providing students with role models is critical, especially the contributions made by STEM professionals from minority ethnic backgrounds. In mathematics, students actually have an assignment about looking up role models in mathematics as part of a professional skills module, which are supported by websites created and disseminated by staff which celebrates scientists from underrepresented background who made significant contributions in their respective STEM discipline. Similarly, staff in quantity surveying were able to include international examples of buildings in different countries in an attempt to move away from a UK-centric curriculum. In the natural sciences, staff mentioned their attempts to teach students about unconscious biases and incorporated how to work in a group effectively into their teaching. Others have mentioned trying out different forms of assessment as well as being more conscious to promote diversity in student groupworks.

More generally, staff suggested the value of inviting alumni from minority backgrounds as speakers or mentors, to show current students that someone who was once in their position has now become a

successful STEM professional (e.g., as a possible career pathway). In biological sciences, staff mentioned that they have plans to initiate a mentoring scheme, but not exclusive to minority ethnic students. The idea is that each student has an alumni mentor who they can look up to and go to for advice. Others have suggested the potential of peer observations, a current University policy where staff audit and feedback of each other's teaching, to include a focus on diversity and inclusion. If changes to the existing teaching commitments of staff are not overly onerous, and just a minor tweak to existing practices, then it is more likely to be successful.

# 6. Recommendations

Based on the evidence gathered, we make the following recommendations, which are discussed in more details in our respective manuscripts.

## 6.1 Institutional level actions

**Recommendation 1:** At the university level, it is critical that there is top-level commitment to acknowledge and address issues of racial inequality, irrespective of departments and disciplines. For meaningful changes to happen, we concur with the view that *everyone* needs to be onboard and share the vison for racial equity in all aspects of higher education. Responsibilities for action must be shared by every segment of the institution. Our students argued that if everyone has a greater understanding of issues of racism then everyone would not only be better informed to support minority ethnic peers, but also better prepared to recognise and fight against racial inequalities. It is, after all, everyone's responsibility. Such dedication should be public and transparent, which might take, in the first instance, the form of a centralised website on the university's work in race equality, as well as the university's planning and strategy (e.g., as a Key Performance Indicator).

**Recommendation 2:** To rehearse an exhausted call, institutions have a responsibility to eradicate racism. A zero-tolerance policy must be actively enforced and regularly revisited so that staff and students are aware and conscious of how existing practices can reinforce a hostile environment for underrepresented groups. Concerns have been raised about the lack of transparency and confidence in the grievance process, and so it should be a priority that the complaint procedures and systems of support are reviewed and revised to ensure it remains 'fit for purpose'.

**Recommendation 3:** Our findings suggest more work is needed to dismantle a culture of silence with a proactive strategy that promotes the normality of verbal resistance against racist behaviours. We acknowledge that speaking up is only the first-step, albeit an important one, especially since casual, subtle and implicit forms of racism or racial microaggression can often be normalised and accepted, including by minorities who may themselves be racial victims.

**Recommendation 4:** In particular, open discussions about race and racism would be essential to encourage more meaningful, realistic and reflective conversations about issues of race, ethnicity, diversity and inclusion at university. These discussions ought to occur for all staff and students, and may be led centrally or locally, with internal and external speakers to share their own respective practices and concerns. The precondition, however, is that universities must provide staff and students with a safe space to express their comments, concerns or complaints. There are suggestions of the use of anonymous comment boxes or submissions. Relatedly, given the Anglocentric structure of UK higher education, we ought to explore how cultural and religious events might clash with assignment or exam deadlines. A forum might be useful to discuss a tangible and fair way to address these associated challenges.

**Recommendation 5:** We echo concerns over the lack of staff and student diversity, including visible role models for minority ethnic students, which continue to undermine students' sense of belonging at university, with fears that staff and fellow students lack empathy or understanding of their unique experiences and concerns. Students still worry about being stereotyped or made to feel as the one odd out. We need a more balanced student cohort across STEM degrees, from gender to ethnicity to a variety of social backgrounds. In the short-term, staff need to ensure that minority ethnic students in their programmes do not feel isolated or alone, which may involve the creation of communities or social groups that brings people together. Where minority ethnic student numbers are few, these networks may comprise of the whole department/faculty, across multiple disciplines or

even the whole university. It was suggested that departments could make greater use of a physical or virtual 'wall of fame', where stories of alumni and their pathways, especially underrepresented groups, are celebrated. Our students believe that exposure to staff from different ethnic and cultural backgrounds will not only improve the breadth and content of the curriculum, but also provide lived examples of how the discipline is actively contributed by people from different backgrounds, which can strengthen students' self-identities and aspirations.

**Recommendation 6:** It was no surprise that we found minority ethnic students to gravitate towards 'people like me' in search for mutual understanding and a sense of belonging. These social groupings are powerful dividers. Universities and staff may need to play a more active role to promote opportunities for social mixing. Whilst we cannot dictate the student peer groups, especially outside of teaching, we must promote the value and importance of diversity. We note the potential value of a buddying sign-up system where individuals attend and participate in events alongside someone else. For student unions, we support ongoing efforts by student unions to promote and facilitate a broader type of social activities, especially non-drinking events. More broadly, greater consideration should also be given to students who commute and/or with caring responsibilities.

**Recommendation 7:** Our students highlight the value of a diverse curriculum. The anticipation here is that with greater staff diversity, a wider range of values and perspectives will be incorporated into STEM teaching, especially away from Anglocentric curriculums (Bianchini, Whitney, Breton, & Hilton-Brown, 2002). We appreciate there are institutional efforts to diversify and decolonise the curriculum in higher education (Liyanage, 2020; UCL, 2020), although Winberg et al. (2019) found in their review that such work within STEM disciplines is actually very limited. Furthermore, Haynes and Patton (2019) warned that STEM staff, especially those from White ethnic backgrounds, often view their disciplines as 'race-neutral', informed by a positivist and objective paradigm. Perhaps the prerequisite of

a diverse and inclusive STEM curriculum ought to begin with staff and their acknowledgement of potential racial bias within their discipline. In short, a diverse and inclusive curriculum is seen to be a contributing issue that can strengthen the educational experiences and outcomes of minority ethnic students, although this requires, first and foremost, active support from staff.

**Recommendation 8:** With a focus on the degree awarding gap, most students recognise the prevalence of financial challenges and constraints amongst minority ethnic groups. As such, universities are encouraged to consider the provision of greater economic support for minority ethnic students, which will improve access and a more diverse student population that can also promote their sense of belonging (Bunce, King, Saran, & Talib, 2021; Dortch & Patel, 2017). With less economic stress and concerns, the mental health and wellbeing of students are likely to improve, which in turn, can positively influence their academic engagement and outcome (Benson-Egglenton, 2019). Whilst there are debates on the merits and dangers of a quota system, and affirmative action in education more broadly, UK universities are moving towards a greater use of contextual data to widen student access to higher education (Boliver, Gorard, & Siddiqui, 2021; Mountford-Zimdars, Moore, & Graham, 2016) – an important step that recognises but also attempts to rectify unequal starting points. Although contextual admission is predominately underpinned by concerns of social class inequality, these principles, we argue, can be applied for minority ethnic students to acknowledge their lived experiences of racial disadvantages. Universities should therefore provide targeted support for disadvantaged students, although we appreciate there are concerns about student support provisions that may be available to some but not all students (Zhou, 2017). In practice, it may be that certain initiatives are promoted more aggressively for targeted students even though it is accessible for all students. For financial assistance, there are few but growing number of scholarships with ethnicity as a selection criterion, which we believe would be an effective strategy to reduce the ethnicity degree awarding gap. There are caveats. Economics are

important but constitute just one of many facets of racial inequality that can influence outcome.

## 6.2 Staff and student level actions

**Recommendation 9:** Staff and students will benefit from a structured programme of diversity and equality training or induction that is underpinned by the aim to tackle racism. Such workshops need to acknowledge that racism exists, from explicit to implicit to subtle forms of prejudice or discrimination, where examples, scenarios or even visual demonstrations will aid clarity and promote active resistance. We need to challenge and dispel the *ideology* of a fair and equal society and the *reality* of inequalities as lived by many marginalised groups. New students may be educated as part of induction and existing students may complete a regular refresher course. The workshop/course should have clear written expectations and detailed information on what and how we should recognise, respond, react and report racial incidents, as well as to promote the roles and responsibilities of individual student to safeguard an inclusive culture and to actively call out any forms of racism. Support and training should also be available for staff and universities ought to consider the merit of a compulsory training on racial awareness and equality. Optional workshops tend to 'preach to the converted'.

**Recommendation 10:** It is important that higher education staff have the time and space to reflect on their own privileges and biases as part of their personal and professional development, which could lend active changes to the way one teaches and views issues of diversity and inclusion. For this to be successful, resources are required to support this aspiration, including staff training. Our case-study revealed that many staff are open, willing and proactive to better diversity and inclusion practices, but would want expert support, guidance and training, beyond the limited impact of short online courses. Relatedly, we need to explore how staff can develop the confidence to incorporate discussions of race, ethnicity and diversity in their existing teaching and learning practices. To reduce perceptions of bias, students have called for all

coursework, where feasible, to be marked anonymously. Relatedly, there are increasing calls and awareness on diversifying and decolonising the curriculum. We acknowledge the complexities of these terms, but our STEM staff would benefit greater support and training on inclusive and diverse teaching in their respective disciplines.

**Recommendation 11:** We support calls for the establishment of a student committee, working group or network that focuses on race and ethnicity to appreciate the challenges and concerns of students (EHCR, 2019). Such a platform has the potential to promote a stronger sense of belonging for those who may feel alienated due to racial, ethnic or cultural differences. We understand that such networks may also already exist in a number of UK universities, and so it is important that voices from these networks are heard and acknowledged across different levels of decision-making committees.

**Recommendation 12:** We found evidence of uncertainty amongst minority ethnic students and their understanding of the 'higher education game'. More specifically, minority ethnic students must be able to feel comfortable and entitled to seek support and response from staff. If these communication protocols or etiquettes are not clearly explained or mutually recognised by students and staff, then the practice of implicit and unspoken rules are likely to flourish, which is likely to disadvantage students with a lower sense of entitlement or fewer understandings of the rules of higher education. To mitigate, and to adopt the concept of the 'ideal student', expectations of students must be explicit and transparent, including what is desirable and rewarded, as well as what is undesirable and penalised (Wong & Chiu, 2020, 2021a, 2021b). Staff may even consider compulsory timetabled tutorials to reduce stigma of 'asking for help' (Wong & Chiu, 2019). Here, we should focus on student empowerment and how universities ought to support students, especially those from minority ethnic backgrounds, to capitalise on the different opportunities afforded by higher education (Brooms, Clark, & Smith, 2018). Existing literature has warned that minority ethnic students are more reluctant to seek available support at

university and less likely to participate in extracurricular activities, due to differences in cultural expectations or obligations, which can negatively impact on their degree outcomes (Stuart, Lido, Morgan, Solomon, & May, 2011). To maximise the values offered by the breadth of available resources and activities, we suggest that universities need to be proactive and reflective to ensure that barriers to these participations are reduced or eliminated through additional support or alternative provisions. All students would then be encouraged to embody and exert greater agency to broaden their experiences and horizons. Yet, for any strategies or initiatives to work, all stakeholders must play their part, including students themselves.
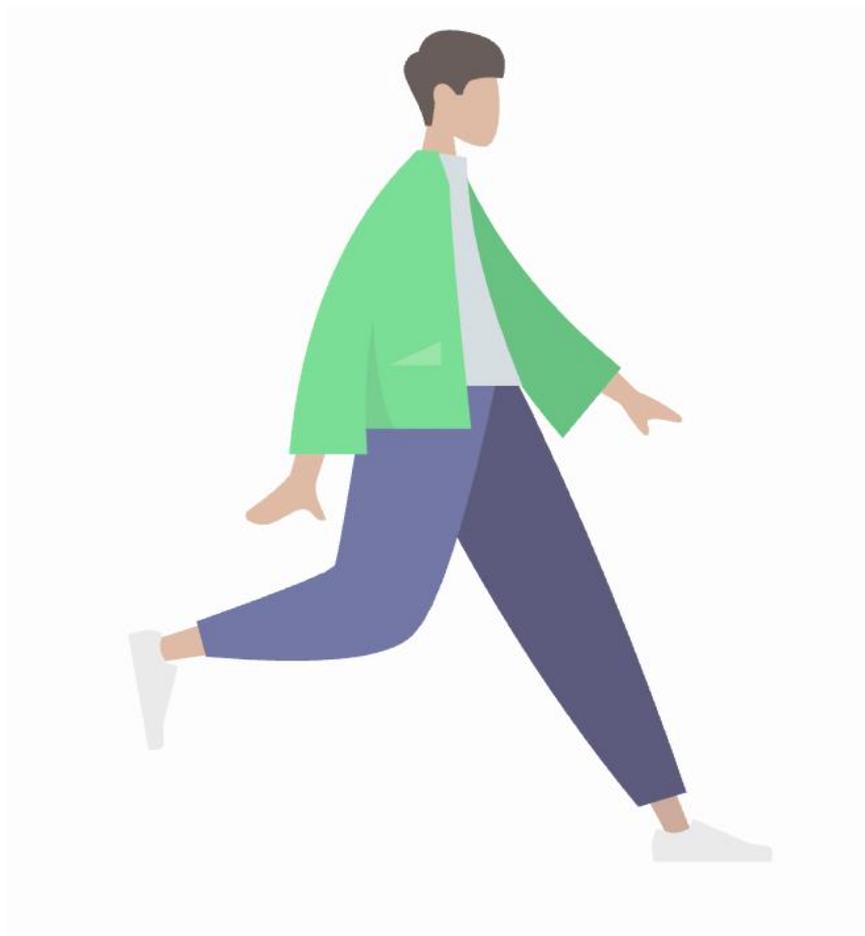
## 6.3 Mapping our recommendations to the University

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|---|---|
| **Recommendation 1** | More specific to our own institution, the recent *Race Equality Review* from the University of Reading (2021) offers a welcome start to a long-term commitment and strategy to tackle racial inequality. It is important that there are regular reviews and reflections on the promises, progress and potential problems to ensure that any changes are sustainable. Perhaps the 20 recommendations could be part of a public dashboard/website where progress and actions are transparent. |
| **Recommendation 2** | The *Race Equality Review* (2021) also recognises the urgent need to reinforce a zero-tolerance policy, via RUSU and the *#NeverOk* campaign. |
| **Recommendation 3** | We acknowledge the ongoing efforts of the *#NeverOK campaign* but felt the message may not be specific enough or widely communicated across the University. A stronger publicity campaign should be considered, which might include digital and physical posters throughout the campus (e.g., toilets, lecture halls and noticeboards). Similarly, students have voiced concerns over the lack of wider awareness on the breadth of available support, with the *Me@Reading* portal not as useful as anticipated. A regular reminder, from staff as well as from central services, will be important, including an accessible 'map' of the available support to be widely publicised. |
| **Recommendation 5** | We recognise the value of initiatives such *as Faces of Reading* and broader commitments as outline in the annual Diversity & Inclusion reports. However, it is not entirely clear what resources and initiatives are used or planned to improve the ethnic diversity of staff and students. |
| **Recommendation 9** | We acknowledge the ongoing efforts by CQSD in the provision of optional diversity and inclusion training, as well as personal development trainings such as *RISE* and initiatives such as the *MyName* project. |
| **Recommendation 10** | We recognise the efforts of some staff to promote diversity in their teaching, including, as an example, the creation of a *website* to showcase diverse role models in mathematics. |

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# Appendix – Methodology

The SESTEM project was a three-year qualitative study that investigated the lived experiences of minority ethnic students in STEM undergraduate degrees at the University of Reading. By STEM disciplines, this would include the schools of Mathematical, Physical and Computational Sciences (MPCS), Psychology and Clinical Language Sciences (PLCS), Chemistry, Food & Pharmacy (CFP), Biological Sciences (BS) and Construction Management and Engineering (CME).

Data collection began in Autumn 2018 with a call for STEM undergraduate participants, especially those who self-identify as a minority ethnic person. We approached over 100 staff in STEM departments across the university to seek support and permission to recruit their undergraduates, which resulted in over 60 in-person short presentations about the project at beginning or end of a subject lecture. Further details were also circulated through students' virtual learning environment.

Whilst we targeted UK-domiciled minority ethnic undergraduates, our recruitment yielded interest from those who self-identified as White British. In total, we collected 155 journal reflections and 88 in-depth interviews over the three years, with 57 unique students, 42 of whom from minority ethnic backgrounds. Students identified with a range of ethnic backgrounds, including Black, East Asian, Middle Eastern, Mixed, South Asian, White British and White European.

For students, participation involved submission of two guided journal reflections and an interview each year, over the course of their degree. For the journal reflections, students were asked to submit their responses electronically at the end of the autumn and summer terms. A Word template was sent to students with guided questions, which asked for their written views and reflections about their summer experiences/plans, the beginning/end of term (including transition into university for first-year participants), academic progress, available support and overall thoughts on their development in the last few months. A typical journal submission we received is around 700-1,000 words.

The semi-structured interviews were conducted in the spring terms, between the journal reflections. On average, these lasted an hour and were conducted in quiet rooms across the university (in Year 1 of the project), although these were moved online in Years 2 and 3 of the study due to the coronavirus pandemic. The quality and depth of data collected seemed consistent between online and face-to-face interviews. Students were asked to share their views on a range of topics, including their experiences of university and the role of 'race'/ethnicity in their STEM education. All interviews were audio recorded and transcribed verbatim, with sensitive details removed. An e-voucher was provided as a token of appreciation.

Data analysis was informed by a social constructionist perspective, which understands social phenomena as socially constructed and discursively produced (Burr, 2003). Interview transcripts and journal reflections were imported into the qualitative data analysis software, *NVivo*, as provisional codes were created when 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 through the comparison of data (Corbin & Strauss, 2014).

A coding framework was then established, with a guided list of definitions for each code after the authors independently coded five interview transcripts and journal reflections by relevant themes. These themes were then discussed and compared, with any differences on the application of codes debated until a consensus was reached. The codes were also grouped together into higher-level themes, corresponding to the study aims and purposes, which is to understand the lived experiences of minority ethnic students in higher education.