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Published version

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The Equator Project Research School and Mentoring Network: Evaluated Interventions to Improve Equity in Geoscience Research

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Received: 13 March 2024

Accepted: 15 July 2024

Published: 04 September 2024

Citation:

Dowey N, Lawrence A, Raji M, Jackson C, Williams R, Fernando B, Giles S, Barclay J, Brotherson L, Childs E, Houghton J, Khatwa A, Mills K, Jameson G, Rockey F, Rogers S and Souch C (2024) The Equator Project Research School and Mentoring Network: Evaluated Interventions to Improve Equity in Geoscience Research. *Earth Sci. Syst. Soc.* 4:10123. doi: 10.3389/esss.2024.10123

There is a well-documented racial and ethnic diversity crisis in Geography, Earth and Environmental Sciences (GEES) subjects in the Global North that leads to inequities in who does environmental research. The Equator project set out to increase participation and retention of UK-domiciled Black, Asian and minority ethnic students in GEES research by developing evidence-based, ring-fenced, fully remunerated interventions. These interventions were co-created with and informed by the voices of students and professionals within the GEES community, following a Theory of Change-based, action research approach. The Equator Research School brought together 30 Black, Asian and minority ethnic students in GEES, and 12 academics, professionals and mentors, from across the UK for a 5-day residential workshop in April 2022. The Research School was designed to facilitate network-building, improve awareness of research careers, enhance confidence in continuing in research, and strengthen a sense of belonging in GEES research for participants. The Equator Mentoring Network, which took place from January to May 2022, facilitated networking between 10 Black, Asian and minority ethnic student mentees and 20 academic and industry mentors involved in GEES subject areas. The overall goal of the Mentoring Network was to increase retention of Black, Asian and minority ethnic students into postgraduate research and to improve their overall experience. Evaluation of these interventions took the form of surveys to capture thoughts and reflections before, during and after interventions. Participants in both interventions provided very positive feedback; the majority of those involved felt a

stronger sense of belonging and inclusion in GEES research and were more likely to consider a research career after taking part. The evaluation process showed unequivocally that the ring-fenced, discipline-specific, fully funded nature of the interventions was a critical factor in participant involvement. The work led to the development of recommendations for creating successful interventions for improving participation and retention in research, as well as templates for future, related EDI activities.

Keywords: diversity, inclusion, doctoral study, doctoral recruitment, student experience, student retention, widening participation

INTRODUCTION

There is markedly lower representation of Black, Asian and minority ethnic¹ students in postgraduate research than in undergraduate or taught postgraduate study in the United Kingdom² (UKRI Office for Students, 2019; Dowey et al., 2021). This ultimately leads to very poor representation within senior levels of professional GEES research (e.g., IES, 2024), with implications for the outcomes of that research in broader society. This disparity is influenced by factors across the educational lifecycle. For example, Black, Asian and minority ethnic students are less likely to be awarded a 1st or 2:1 undergraduate (UG) degree than their white counterparts³ (Office for Students, 2022) and are less likely to attend the high-tariff research institutions that act as feeder universities for most postgraduate research (PGR) study⁴ (GOV UK, 2022). These groups are also more likely to lack a sense of belonging in higher education (Mountford-Zimdars et al., 2015) and are particularly vulnerable to withdrawing from their undergraduate degree (Woodfield, 2014). Evidence shows that this situation is a result of inequitable frameworks and racism that systematically disadvantages students from excluded ethnic backgrounds (Leading Routes, 2019).

The lack of racial and ethnic diversity in GEES in the Global North is well-documented. In the United States, the geosciences are “the least diverse of all STEM fields” and

the number of geoscience doctoral candidates from underrepresented minority groups has stagnated for the past 40 years (Bernard and Cooperdock, 2018). In the UK, the picture is similar. Of 44 physical science topics categorised by the Higher Education Statistics Authority (Higher Education Statistics Authority, 2022), GEES-related topics are amongst the very lowest in terms of ethnic minority representation at undergraduate level.⁵ The picture is typically worse in PGR study. For example, from 2014 to 2019, on average, representation of ethnic minority students was lower at PGR than UG for both Earth Science and Physical Geography (Dowey et al., 2021). In 2020–21, ethnic minority representation in Earth Science was 12% at UG compared to just 8.7% at PGR (Higher Education Statistics Authority, 2022); well below government census data showing that 21.5% of UK 18–24-year-olds identify as Black, Asian or minority ethnic (GOV UK, 2021).

The under-representation of ethnic minorities in GEES permeates the highest levels of academia and related professions. Across the United Kingdom, just 10.8% of professors identify as Black, Asian and minority ethnic; but of the 2,390 staff working in Earth, marine and environmental sciences in 2018/19, only 90 (3.9%) identify within these groups. This is the second lowest figure of all science, engineering and technology disciplines in the United Kingdom (Advance HE, 2019; Higher Education Statistics Authority, 2019). The environment sector is one of the least ethnically diverse professions in the United Kingdom (IES, 2024). In a 2017 UK Policy Exchange report, the environment sector was ranked as the second least ethnically diverse, with 3.1% of environmental professionals identifying as non-white British ethnicities *versus* 19.9% across all occupations (Policy Exchange, 2017).

A variety of discipline-specific issues disproportionately impact Black, Asian and minority ethnic students in GEES and have been summarised in previous studies (Dutt, 2020; Fernando and Antell, 2020; Marin-Spiotta et al., 2020; Dowey et al., 2021). They include the legacy of colonialism and resource exploitation, fieldwork accessibility, discriminatory stereotypes and lack of visible role models, hostile

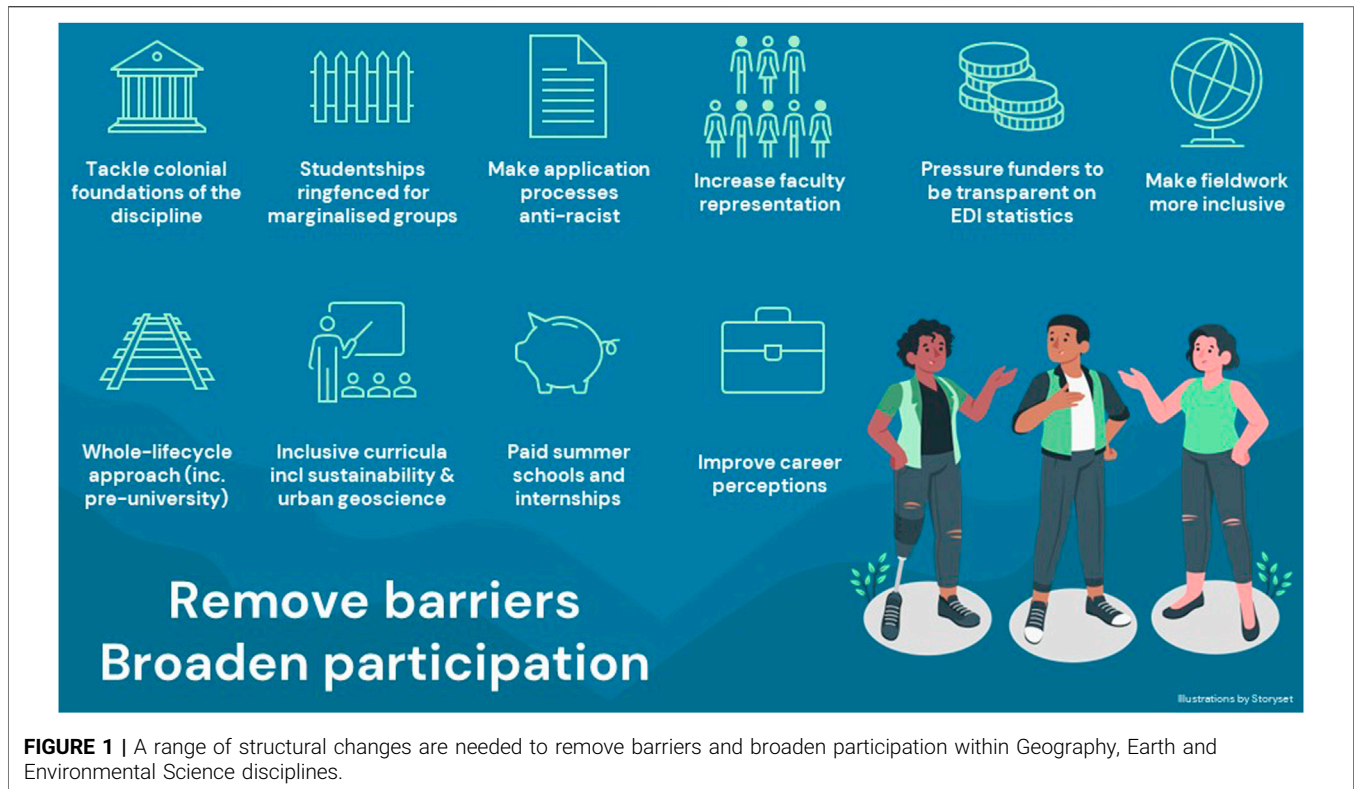
¹This grouping is used here in line with Higher Education Statistics Agency reporting, but we recognize that it homogenises different identities and obscures experiences felt by one race or ethnicity.

²In 2020–21, 70% of UK domiciled students undertaking full time undergraduate study were white, and 27% were Black, Asian or minority ethnic. 70% of those undertaking full time taught postgraduate study were white, and 25% were Black, Asian or minority ethnic. For postgraduate research, 77% of students were white and just 17% were Black, Asian or minority ethnic (Higher Education Statistics Authority, 2022).

³In 2020–21, there was a difference of 17.4 percentage points between the proportion of white and black students getting a 1st or 2:1, with the 1st awarding gap growing in recent years (Office for Students, 2022).

⁴In 2020–21, 77.4% of students at high tariff providers were white and 20.8% were Black, Asian or mixed ethnicity; 71.1% of students at low tariff providers were white and 26.6% were Black, Asian or mixed ethnicity. The disparity is greatest for Black students (4.4% in high tariff *versus* 11.5% in low tariff providers) (GOV UK, 2022).

⁵CAH identifiers 26-01-01, -02, -04, -05 and -06: average 9.7% representation compared to overall average of 23% across all physical science subjects



environments, and career perceptions. Such disadvantages are multidimensional, with ethnicity being just one barrier; intersecting characteristics may act to increase the marginalisation felt by any one student. For example, a more complex picture of disadvantage occurs when ethnicity is considered alongside socioeconomic indicators of disadvantage (Office for Students, 2024). Anand et al. (2024) found that the career paths of UK geochemists belonging to multiple disadvantaged groups are restricted, and that women from ethnic groups are lacking representation in senior or leadership roles in academia.

The issues highlighted above matter, given that geoscience knowledge has an essential role to play in equitable and sustainable development; it cannot, however, be applied without equity among those studying and working in GEES subjects. The less diverse a field is, the less welcoming it is to minority groups, and “the more prevalent implicit biases become” (Dutt, 2020). To be able to address global problems and work with people from all communities, the GEES community must acknowledge and tackle subject-specific structural inequities that have long persisted (Dutt, 2021). Such reform is needed in areas across the GEES academic pipeline (see **Figure 1** and references within Dowey et al., 2021), with work and recommendations to decolonise geoscience, address racism, develop more inclusive curricula and environments, and improve fieldwork accessibility gathering pace (e.g., Dutt, 2019; Anadu et al., 2020; Marín-Spiotta et al., 2020; Núñez et al., 2020; Ali et al., 2021; Dutt, 2021; Greene et al., 2021; Morris, 2021; Geocontext,

2022; Lawrence and Dowey, 2022; Rogers et al., 2022; UK Research and Innovation, 2022; Yorke et al., 2022; Acosta et al., 2023; Cisneros and Gulincozzi, 2023; Fernando et al., 2023; Marín-Spiotta et al., 2023; Decolonising Earth Science, 2024; Fox et al., 2024; GAIA, 2024; Holliman et al., 2024; Rogers et al., 2024).

The Equator project targeted the transition from undergraduate study to postgraduate research, with the aim of increasing participation and retention of Black, Asian and minority ethnic PGR students in GEES subjects, ultimately leading to increased racial and ethnic diversity in GEES research in the United Kingdom. This was done through the creation of a doctoral recruitment working group to remove barriers to access [the findings of which are reported in Fernando et al. (2023)], and the delivery of two action research-based interventions (a Research School and Mentoring Network) to improve access and retention, the findings of which are presented in this paper.

Access and Participation

Ethnic minority students are more likely to feel disconnected from research networks and lack awareness of research opportunities and careers (Adwoa et al., 2022). This disconnect is related to many structural and cultural factors, such as a lack of exposure to active research in their field; ethnic minority students are less likely than their white counterparts to attend research-intensive universities (GOV UK, 2022), and have less access to opportunities such as

internships and workshops that build confidence in their ability to undertake research (Adwoa et al., 2022).

Previous initiatives have demonstrated the power of bringing people from marginalised ethnic backgrounds together to improve access and participation in research. In the United States, work at Lamont-Doherty Earth Observatory demonstrated that creating immersive, *paid* opportunities for ethnic minority students to engage in research themes in a nurturing environment leads to increased engagement with STEM in higher education (Dutt, 2019). In the UK, the National History Museum Explorers Programme (Natural History Museum, 2022a) has successfully provided ring-fenced⁶ events and resources to support students from marginalised ethnicities to pursue research and career pathways in Earth, environmental and ecological sciences. Targeted research schools for ethnic minority students improve participants' awareness of career paths and opportunities, as evidenced in other disciplines such as physics (Wade et al., 2022). Work with other minoritised groups, such as the Access Anglesey project for geology students with mental health, learning and/or mobility conditions, has proven the value of residential, discipline-specific events to improve access and inclusion (Houghton et al., 2020).

Student Experience and Retention

Black, Asian and minority ethnic students studying GEES subjects in the UK are likely to be isolated in their learning environments. They may be the only students of colour in their department (Thomas et al., 2007; Dowey et al., 2021) and lack access to visible role models (Universities UK and National Union of Students, 2019; Fernando and Antell, 2020). Ring-fenced workshops for UK geoscience undergraduates and recent graduates from underrepresented groups found that these students may experience alienation from peers and feel isolated (Adwoa et al., 2022).

Work undertaken by grassroots groups such as Black in Geoscience and Black Geographers (Black Geographers, 2024) shows the benefits of building networks within ethnic minority student communities. Research within the environment sector has highlighted the importance of sense of belonging and networks for professionals (IES, 2022). Grassroots efforts to share experiences and improve sense of belonging in academia such as the X (formerly Twitter) #BlackInTheIvory hashtag have highlighted the bias and discrimination faced by students of colour, and demonstrate the importance of connecting students and staff with shared lived experience to support, encourage and share opportunities to those students who may feel isolated.

Mentorship has positive impacts on the sense of belonging and overall outcomes for Black, Asian and minority ethnic students across academia (Thomas et al., 2007). As a result, mentoring programmes have been developed by universities, professional bodies and charities in recent years. Examples relevant to this work are the Cowrie

Scholarship Foundation programme (Cowrie Scholarship Foundation, 2022), which links Black students to mentors with shared lived experience, and the ASPIRE programme (Sheffield Hallam University, 2023), a multi-institution (not discipline specific) effort funded by the Office for Students to improve retention into PGR.

In UK geoscience, mentoring has been recognised as a vital part of improving the sense of belonging for underrepresented GEES students (Adwoa et al., 2022). The Fi-Wi Road internship programme, a collaboration between Black Geographers and the Royal Geographical Society (with IBG) (Black Geographers, 2021), is an example of a successful, discipline-specific mentorship scheme, in this case embedded into a paid internship initiative.

The Equator project set out to build upon previous examples of best practice to develop the first fully remunerated, discipline-specific research training and mentoring programmes for Black, Asian and minority ethnic students in GEES subjects in the United Kingdom.

Theory of Change and Objectives

The Equator project used a Theory of Change (ToC) framework. ToC has most often been used in the development sector and is an outcomes-based approach using critical thinking of how change happens in a given context (Vogel, 2012). A ToC provides a "roadmap" from intervention to outcome, whilst encouraging an on-going process of reflection to explore how change happens.

The Equator Theory of Change (Figure 2) identified targeted interventions at crucial career stages that will quantifiably increase recruitment and retention of GEES researchers from marginalised ethnic backgrounds. The ToC represents the outcomes of many conversations, and involved co-creation, knowledge sharing, reflection and feedback together with minority ethnic students, postgraduate researchers and staff with lived experience of the challenges being tackled. The ToC was further shaped by an EDI consultant and an international development expert to understand the behavioural changes needed to achieve the project goal, and the interventions needed to drive these changes. Assumptions, risks and mitigations were considered (Dowey, 2023). Equator considered both medium-term [discussed in Fernando et al. (2023) and shorter-term interventions (the focus of this work), and the ToC places these within a broader context; the interventions described within this paper are just one part of the structural changes needed within GEES disciplines.

The Research School aimed to increase participation and retention of Black, Asian and minority ethnic students in PGR and beyond. This overall goal was broken down into a series of desired changes, linked to four research objectives (RO): (RO1) facilitate networking and create a broader network of community for the participants; (RO2) improve awareness and perceptions of the broad spectrum of GEES research careers; (RO3) increase sense of belonging in the GEES academic environment; and (RO4) improve confidence in moving forward into GEES research.

The overall goal of the Mentoring Network was to increase retention of Black, Asian and minority ethnic students in GEES study and improve student experience. The four mentoring objectives (MO) were to: (MO1) facilitate networking; (MO2) improve sense of belonging and inclusion for Black, Asian and

⁶Activities targeted to a particular demographic group.

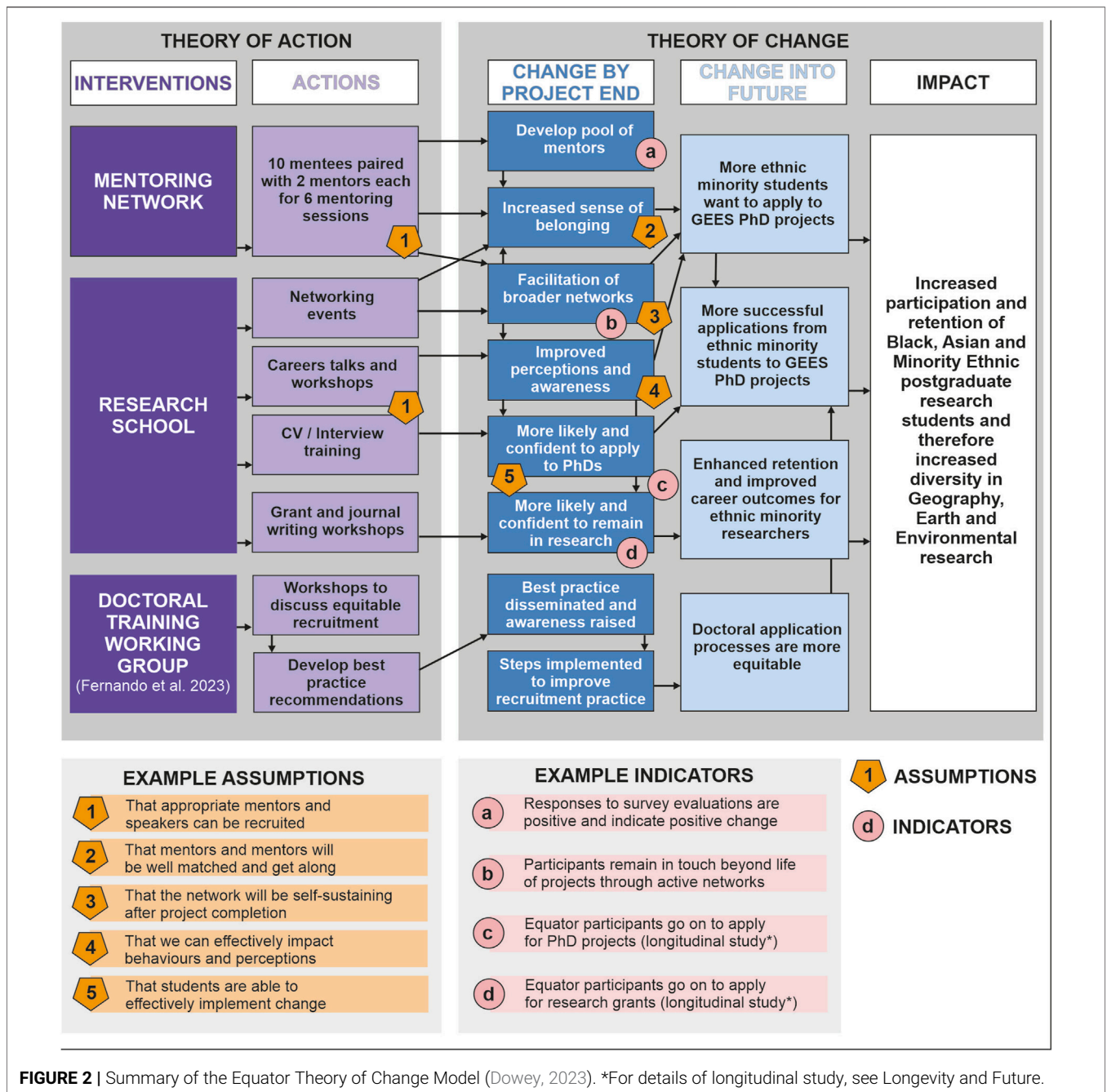


FIGURE 2 | Summary of the Equator Theory of Change Model (Dowey, 2023). *For details of longitudinal study, see Longevity and Future.

minority ethnic students in GEES; (MO3) build a body of experienced mentors to support future students within GEES; and (MO4) improve confidence in moving forward into GEES research.

METHODS

Equator was novel in that it was student-led and collaborative, and applied best-practice from social science qualitative action research to make GEES disciplines more equitable.

Co-Creation and Oversight

The discipline-specific approach of Equator was informed by the voices of Black, Asian and minority ethnic students and professionals within GEES. The Equator Project Team (comprising four Academic Investigators [ND, SG, CJ and RW] and three employed Post-Doctoral Research Associates [BF, AL, MR]) and Steering Committee have worked together since summer 2020, co-authoring EDI-focused research and co-designing interventions that respond to identified needs. The Equator Steering Committee, which provided oversight of project activities, includes students/alumni with lived

experiences of the challenges being tackled, and representatives of some of the grassroots organisations actively engaged in EDI in geosciences (Black Geographers, Black in Geoscience and Diversity in Geoscience UK). The Project Team and Steering Committee include allies in senior research roles, removing some of the burden on minoritised individuals in the group, whilst also ensuring a balance of different levels of experience.

Equator involved collaborative partners across different Higher Education institutions, professional bodies (Geological Society of London, Royal Geographical Society with IBG and Institution of Environmental Sciences), public institutions (British Geological Survey), doctoral training organisations (NERC Panorama, EPSRC-NERC Aura, NERC ARIES, NERC CENTA, and NERC-UK Space Agency SENSE doctoral training organisations), grassroots organisations, and industry. Partners committed time and resources to ensure the success and sustainability of the project outcomes.

Ethics and Code of Conduct

This project included evaluation of experiences of students and professional geoscientists and received ethical approval at Sheffield Hallam University (ER39312553). All findings are presented here in an anonymised, unidentifiable format, and data are available open access through Sheffield Hallam's data repository (Dowey, 2023).

All Research School and Mentoring Network participants were provided with a participation information sheet and consent form for project monitoring and evaluation. It was made clear to participants that they could withdraw from participation at any time, that participation in monitoring and evaluation was not required to partake in activities, and that responses would be anonymous. It was also made clear that if for any reason a mentee was unhappy within their mentor pairing, that this could be reported to the project team and an alternative pairing would be found.

A Code of Conduct was developed for Research School participants, informed by examples such as those created for Geological Society of London conferences (The Geological Society of London, 2022) and the Natural History Museum Explorers Conference (Natural History Museum, 2022b).

Before the Mentoring Network started, kick-off meetings were provided, one for the 10 mentees and one for the 20 mentors. These sessions introduced mentoring and what to expect. In these sessions, a Mentoring Agreement, a document that included a code of conduct for the mentoring process, was introduced to participants. This was signed and returned by each mentor pairing.

Intervention Format and Design Research School Programme

The 5-day Research School was delivered at Sheffield Hallam University in the UK in April 2022. It was designed to create a fully-funded, discipline-specific experience for both undergraduate and postgraduate students from ethnic

minority backgrounds in GEES research. The Research School addressed the project objectives by:

- creating networking sessions that facilitated social interactions, and by providing talks by mentors and role models (RO1, RO3). The decision was taken to have the school in-person to facilitate these important social interactions.
- providing talks and workshops that explain what a PhD is, and that highlight research career pathways inside and outside of academia (RO2)
- providing training sessions on grant-writing, article-writing, geoscience communication, public-profile building, application and interview skills, and a conference day to put presentation training into practice (RO4)

The programme was divided into two streams: 1) PhD students/postdoctoral and 2) Masters and Undergraduate students. The PhD stream was supported by additional sponsorship from the British Geological Survey (BGS). Three of the 5 days involved sessions including both streams, with 2 days of split activities targeted at the different levels. The opportunity for daily interactions between the streams, the external speakers and the Equator Project Team was included. This provided the participants with exposure to a variety of role models of diverse backgrounds in GEES, who themselves were at various stages in their careers.

The Master's/Undergraduate streams of participants attended Research awareness workshops including "how to thrive in your PhD and research career," "preparing for academic career," "a whistlestop tour of applying for a PhD," "creating a PhD application," "research presentation skills" and "PhD interviews." For the PhD stream, the workshops on "grant and fellowship writing fundamentals" and "preparing for an academic career" provided guidance on academic careers and introduced the participants to the funding landscape, fellowship funding opportunities, and generating fundable research ideas.

Workshop sessions were organised so that each built on knowledge from the previous session, and included a mix of skills-based, application-based and discussion sessions (Dowey, 2023). In addition, interactive exercises and hands-on activities promoting critical thinking and inquiry-based learning were incorporated into each session. On the last day, each participant presented a five-minute oral presentation as part of a half-day mini-conference, focusing on their planned, ongoing or previous research. The mini-conference also included highlight talks by a professor of geoscience and a recent geography graduate working with the Royal Geographical Society.

Research School Design

Consultation and brainstorming sessions with recent and current Black, Asian and minority ethnic students, and postdoctoral researchers from the Equator team and Steering Committee, were critical to the successful planning and delivery of the programme and activities of the Research

School. Insights gained from these conversations included creating safe spaces for frank and open conversations, community engagement and skill development, and minimising all costs to participants.

The Research School unavoidably fell over Ramadan due to the timing of the funding and university term schedules. This was considered carefully, with provisions put in place and advertised in advance for applicants. These included Halal food options, the availability of prayer rooms, and scheduling the day around Ramadan prayer times.

The selection of speakers and trainers for the school was based on the goal of having diverse attendees and role models willing to share their lived experience and connect with the participants. Speakers and trainers were paid an agreed fee for time spent preparing and delivering the sessions, as well as their travel and accommodation expenses (apart from Dr Melissa Plail, whose time was gifted by Nature Communications). The four Academic Investigators and three employed Post-Doctoral Research Associates helped facilitate and deliver sessions, and a postgraduate student member of the Equator Steering Committee was also paid a fee for presenting and mentoring during the Research School.

Mentoring Network

The Equator Mentoring Network was fully-funded and ring-fenced for mentees who identify as Black, Asian and minority ethnic, and were studying for or a graduate of a GEES-related subject. The network ran for 4 months (January to May 2022) and involved a total of six mentoring sessions for each mentee. The decision whether to continue the mentoring connection beyond the life of the project was left to each mentor-mentee pairing. The mentoring was designed to meet project objectives by:

- pairing each mentee with both an academic and a non-academic mentor, to provide insights from different sectors and to broaden the network of the mentee (MO1, MO4)
- using mentors with shared and/or relevant lived experience who work in the GEES sector (MO2)
- bringing together a group of mentors who may not have been involved in such schemes before, and providing support to them throughout the process (MO3)

Pairing was conducted by the Equator project team. Participants were asked to provide a brief explanation of why they wished to be involved in the network, as well as brief details of their subject of study (mentee) and job role (mentor). This information was used to link mentees with one academic and one non-academic mentor. Mentor recruitment was not restricted to those from underrepresented ethnic groups, although marketing materials requested that applicants had relevant lived experience. 95% of mentors on the scheme identified as belonging to an ethnic minority group.

Mentoring can take different forms, for example, in nature of support (e.g., moderate *versus* unconditional) and in style (e.g., motivational *versus* informative) (see Leidenfrost et al., 2011 and

references therein). The nature of the Equator Mentoring Network sessions was purposefully left unstructured, to allow each pairing to develop a style of mentoring that worked best for them. However, guidance on possible topics for discussion, and ideas for the first session, was provided in the kick-off sessions.

Participant Recruitment and Remuneration

Recruitment for the Mentoring Network and Research School was via advertising on the Equator project website, across social media platforms, through higher education institution contacts, and via professional body mailing lists. Demographic networks such as Black in Geoscience and Black Geographers played a crucial role in reposting and advertising to target communities. Recruitment materials highlighted the discipline-specific nature of the schemes, explicitly stated the time contribution involved in taking part, and stated eligibility requirements (e.g., for Research School participants and mentees, being over 18 years old, a British citizen and identifying as Black, Asian or minority ethnic in Geography, Earth and Environmental Sciences). As the Equator project focused on the outcomes of UK-domiciled students (as monitored by the Higher Education Statistics Authority), the interventions were not open to international (i.e., non-domiciled) students.

Participant selection for the Mentoring Network took place via email communication, and was conducted on a first-come, first-served basis, subject to eligibility criteria, with a maximum capacity of 10 mentees and 20 mentors due to project funding. 10 additional eligible mentor applicants and 18 additional eligible mentee applicants were added to a reserve list in case mentors or mentees withdrew from the scheme.

The Research School received 53 applications from 20 participants at universities nationwide. After an eligibility check, (which ruled out international applicants), 38 applicants were entered into a lottery. Selection was carried out using a random number generator.

Participants in both the Mentoring Network and Research School were compensated for both their time and expenses to remove financial barriers to access (which can include socioeconomic background, caring responsibilities, and the cost of missed employment). Research School participants received a £250 stipend and were able to claim travel expenses of up to £220 and subsistence of up to £25.60/day for the duration of the 5-day Research School, in addition to lunch and accommodation being provided. Each mentee received a £150 stipend for taking part in six mentoring sessions. Mentors were offered £75 for the three mentoring sessions, although some declined the payment.

Evaluation and Monitoring

To evaluate the effectiveness of the two interventions against the Equator Project Theory of Change and their goals, a variety of evaluation and monitoring techniques were used.

Online Surveys

Online Qualtrics surveys were chosen as the principal method of evaluation for the Research School and Mentoring Network. All surveys were anonymous and the results are presented here

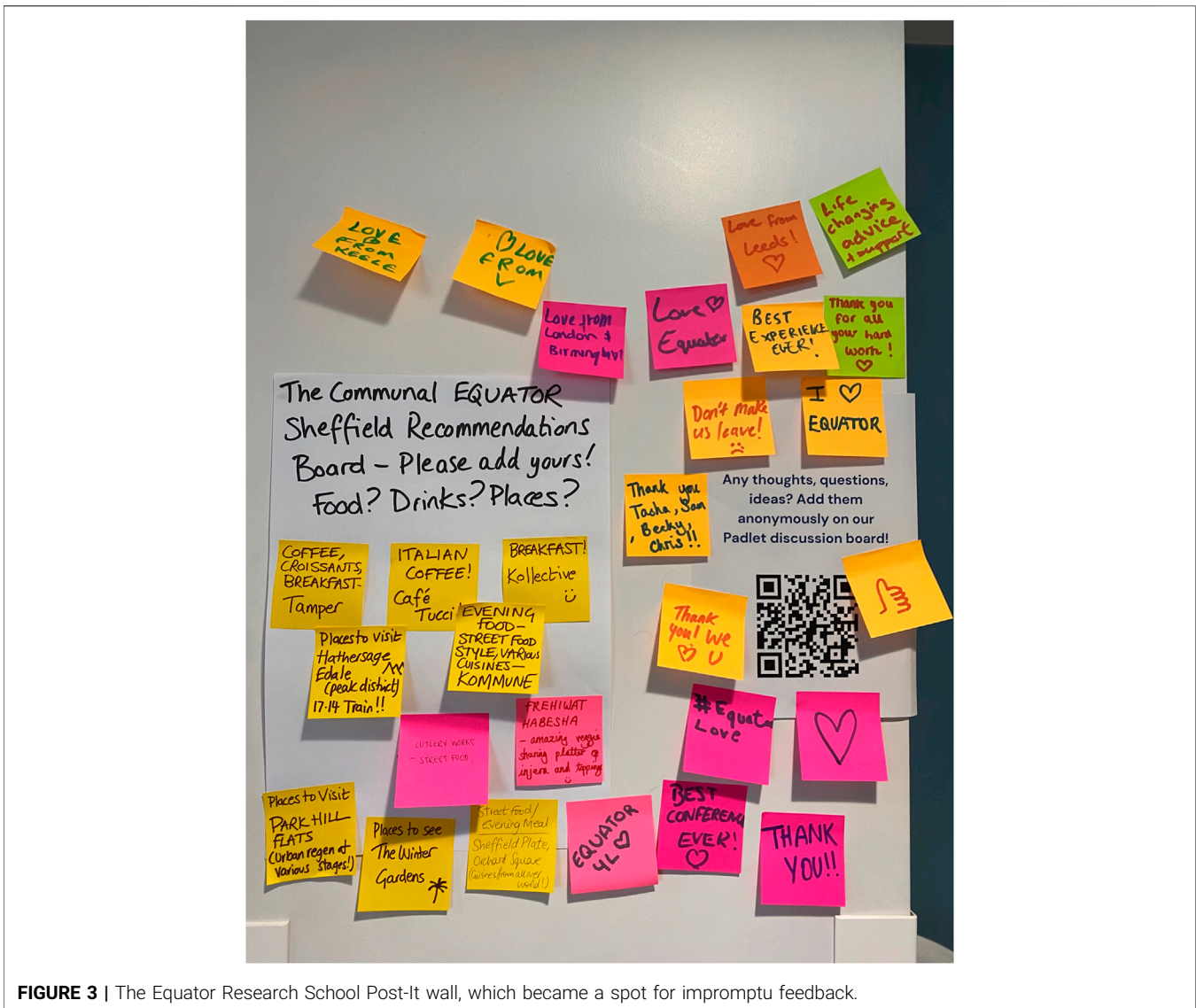


FIGURE 3 | The Equator Research School Post-It wall, which became a spot for impromptu feedback.

in a way that does not identify participants. Demographic data was collected using questions in the format of the UK Government Census.

The surveys, which included both Likert-style and free-text questions, were designed to directly address the objectives identified by the ToC. Questions explored themes including sense of belonging, attitudes toward GEES research, barriers to access, and desire to participate in/continue with postgraduate research. Questions also requested feedback to inform future iterations of interventions (Dowey, 2023).

Where possible, questions were posed in a format allowing for quantitative analysis, to allow for rapid comparison between “before” and “after” data. Many questions also gave an option for free text responses, to obtain additional qualitative (i.e., experiential) data. These responses were evaluated to identify any key themes arising in the surveys and some are included verbatim below to highlight these themes.

The benefits of an online survey approach include convenience of design, low cost of implementation, anonymity, ease of distribution via email, and speed to complete for participants (Evans and Mathur, 2018). However, this approach did create limitations; we could not directly track pre-, mid- and post-intervention surveys due to anonymity; therefore, comparisons are made at an aggregated (i.e., cohort) level. This could be improved in future by asking participants to generate an anonymous code that is included across responses. The surveys, although containing options for free text responses, could have been seen as impersonal, and were potentially limiting for capturing rich dialogue from participants. In future, if more time and resource were available, a mixed-method approach, including selected interview or focus groups, could mitigate some of these limitations; either by using focus groups to co-create survey design with participants [as in Galliot and Graham (2016), for example] or in combination during evaluation to provide a

richer dataset (Savin-Baden and Howell Major, 2013) (see Longevity and Future below).

Research School

The 30 Research School participants were invited to complete two anonymous surveys conducted using Qualtrics software in April 2022, pre-and post- Research School (Dowey, 2023). Of these participants, 28 completed the survey before attending, and 27 completed the post-school survey (response rates of 93% and 90%, respectively). Nine participants attended the PhD Stream of the Research School, and post-Research School survey responses were received from seven (response rate of 78%). 21 participants attended the Masters/undergraduate stream, and 20 responses were received to the post-Research School survey (response rate of 95%).

Informal methods for feedback were also encouraged: an anonymous online Padlet was set up to allow participants to quickly add contributions during the school, and a Post-It wall allowed participants to rapidly capture and feed-back ideas and recommendations to the Project Team (Figure 3). Direct feedback to the Project Team during the event was also encouraged, with a Twitter Hashtag (#EquatorResearchSchool) allowing participants to their share experiences on social media.

The Equator Academic Investigators were present at the Research School and delivered some workshops. The Equator Post-Doctoral Research Associates were also present and gave presentations and participated in workshops. The Project Team used participatory science methods, including developing relationships with community members to construct knowledge (Bourke, 2014). The team's observations and reflections of the school form part of the event evaluation. Positionality is critical to insider/outsider research (Rose, 1997). Evaluation of the event was conducted by the same team that designed and delivered the event, which has the potential to introduce bias: the use of participatory methods may create a potential disconnect between how we have perceived the participants' experiences and the experiences actually felt by the participants. This is mitigated by also using anonymous survey data to evaluate the effectiveness of the intervention.

Mentoring Network

The Mentoring Network was evaluated by inviting each participant to take part in three anonymous Qualtrics surveys (Dowey, 2023), conducted between January and May 2022. The surveys took place at the start, middle and end of the project, with different versions for mentees and mentors. Analysis of the surveys was used to measure attitudes towards mentoring at different stages in the project from different perspectives.

Participants were able to contact the project team at any time to discuss thoughts on the process. In addition, two mid-project group meetings (one for mentees, one for mentors) were facilitated online. This allowed the Project Team to monitor the progress of the project, and to support participants, who could share their experiences and voice

any concerns. These were productive sessions, particularly for the mentors, allowing those in attendance to share ideas and communicate what methods were working best for their pairing.

Of the 10 mentees and 20 mentors, 10 mentees and 19 mentors completed the survey before taking part in the Mentoring Network (100% and 95% response rates, respectively). 10 mentees and 20 mentors completed the survey administered at the midway point of scheme (100% response rates). Eight mentees and 12 mentors completed the post-mentoring survey (80% and 60% response rates, respectively). It is unclear why the reduction in survey completion amongst mentors occurred at the final survey. Non-response is a recognised issue in web surveys (Manfreda et al., 2008); it may be that email reminders were missed due to the timing of the survey at the end of the academic term. It may reflect that participants were happy with the process and did not feel the need to comment; conversely, however, it may reflect that some participants became disengaged or were unhappy with the network. The overall positivity of the recorded responses (see below) suggests that the latter is less likely. The high participation in the first two surveys, and the reduction in response rate in the third survey, may indicate that "over-surveying" impacted willingness to participate (Manfreda et al., 2008); this is something to consider for future interventions.

WHO TOOK PART?

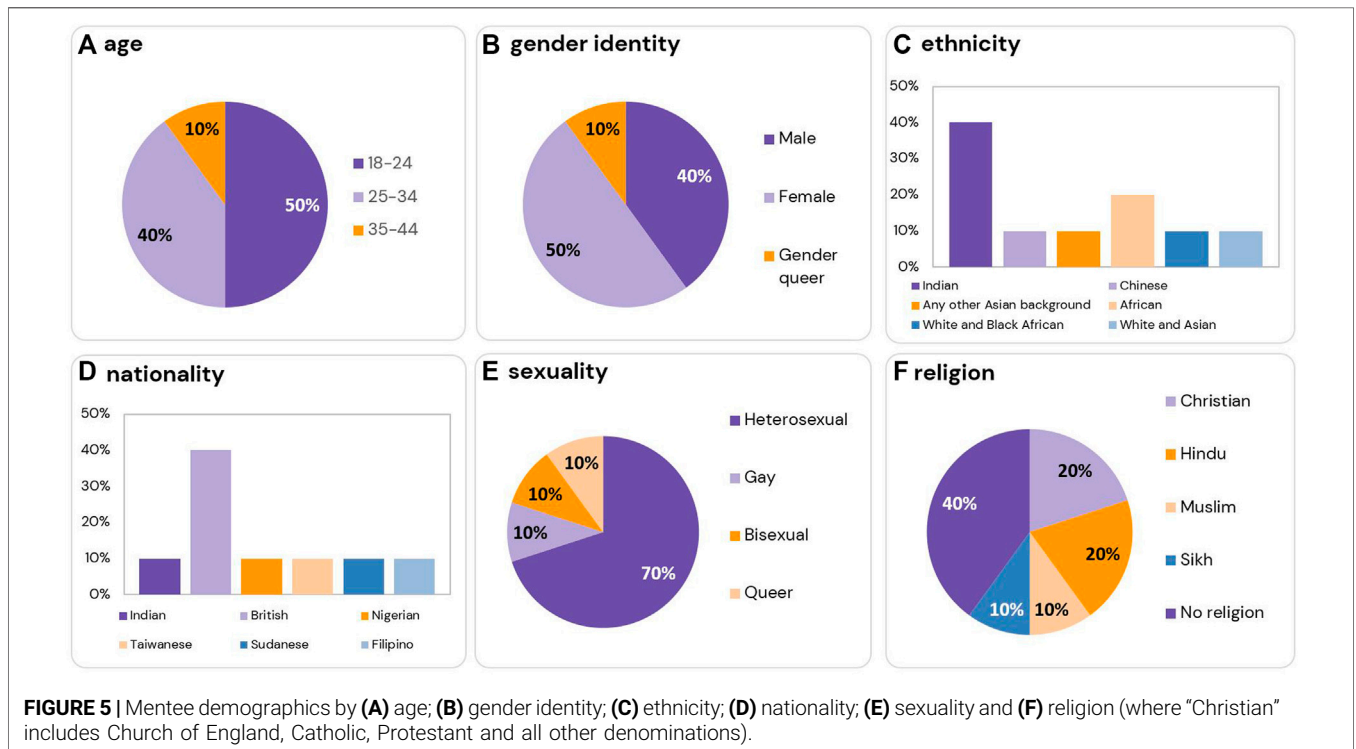
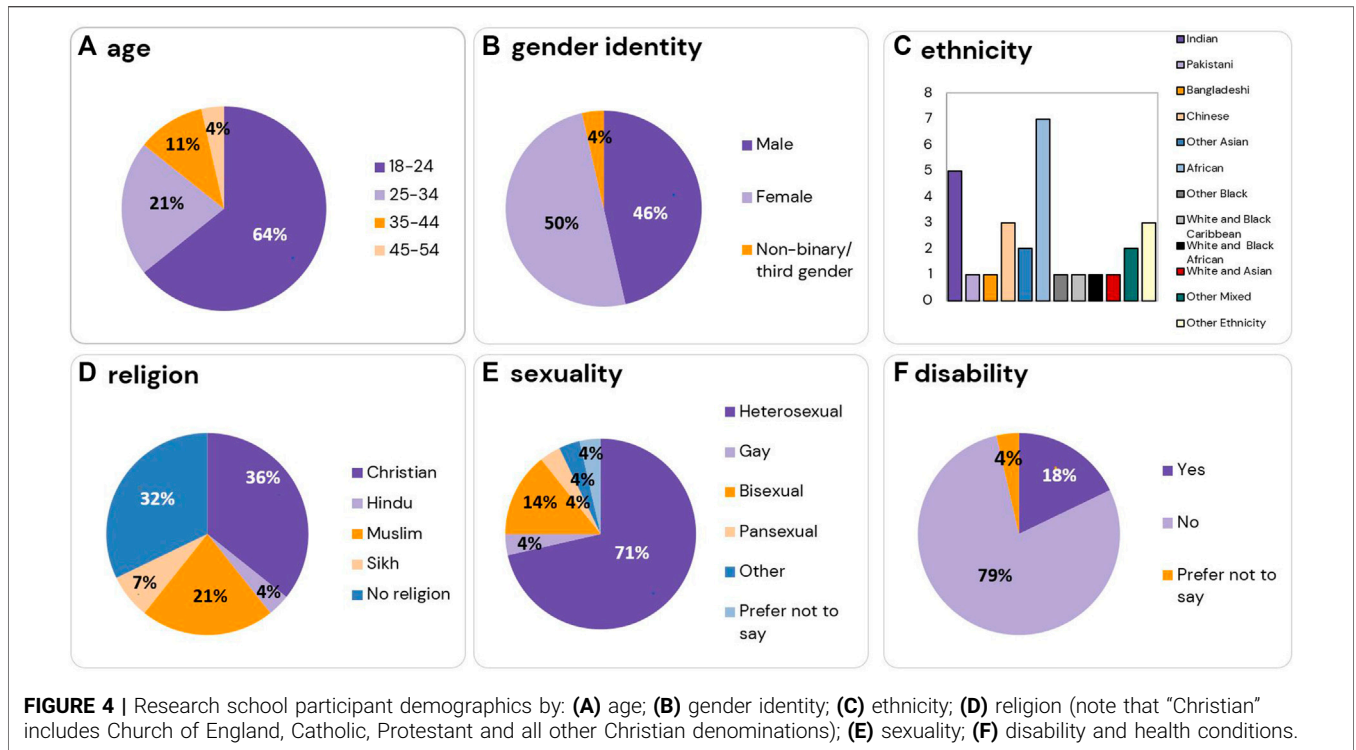
Research School

Most Research School respondents were aged 18–24 and all were younger than 54. Participants were from a range of ethnicities and religions, with multiple gender identities represented (see Figure 4).⁷ Most respondents (62%) identified as heterosexual, with 28% selecting other sexual identities. 18% of respondents identified as having a disability or long-term health condition. 39% of respondents were the first generation in their family to attend higher education. Ten of the respondents felt their degree/research aligned to Earth Science, 10 to Geography, and 8 to Environmental Science/Studies.

Mentoring Network

Mentees ranged in age from 18 to 44, with most falling in the 18–24 category. The mentees came from a range of ethnicities and religions, with multiple gender identities and sexualities represented (see Figure 5). No mentees identified as having a disability or long-term health condition. The mentees were predominantly students, with three undertaking their first degree, one studying

⁷Survey sex/gender questions were guided by GOV UK (2021) Census questions, with additional tick box options for more inclusive self-identification.



another undergraduate degree or equivalent, one pursuing a taught Master’s degree, three undertaking doctorate research, and one involved in other PGR. One participant

was temporarily on a break from work or study. Four were aligned to Earth Sciences, two to Geography, and four to Environmental Sciences/Studies (Figure 6).

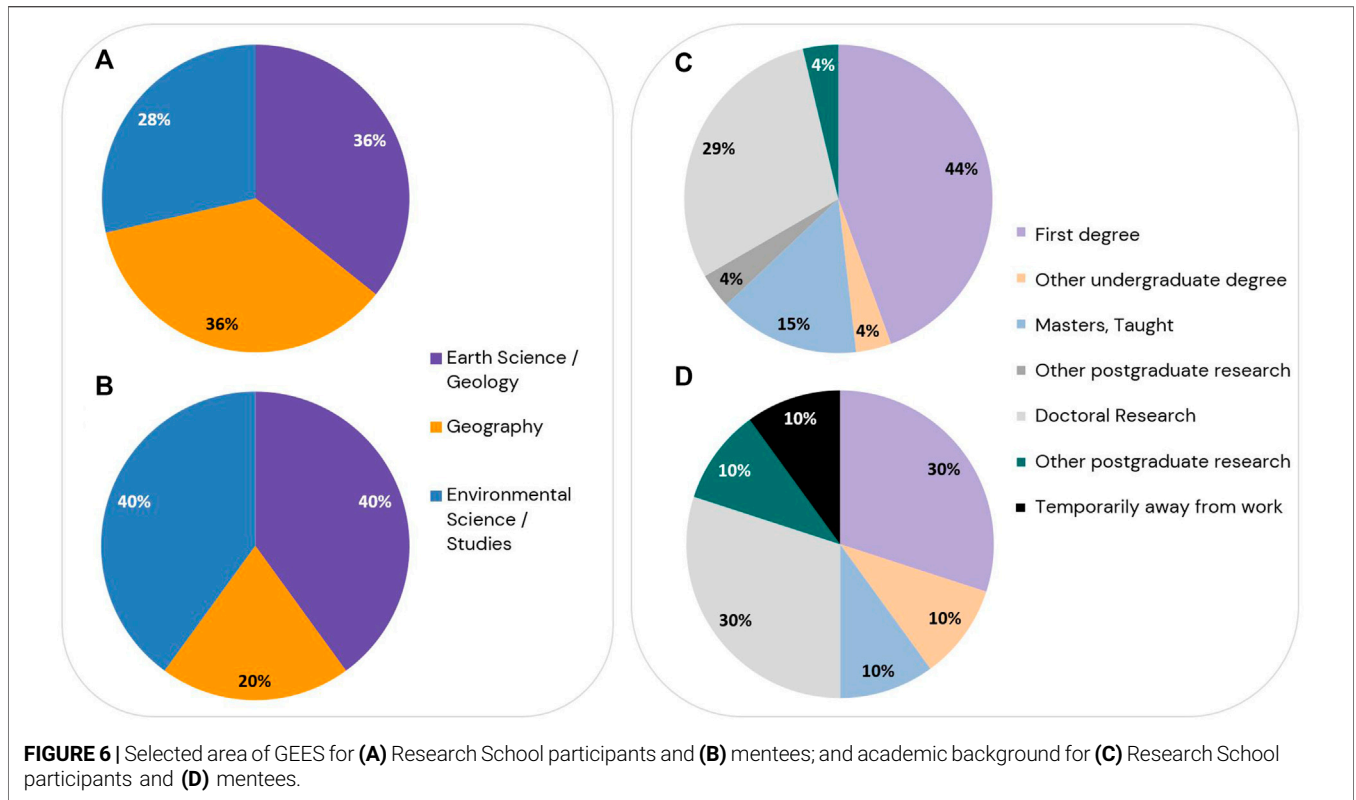


FIGURE 6 | Selected area of GEES for (A) Research School participants and (B) mentees; and academic background for (C) Research School participants and (D) mentees.

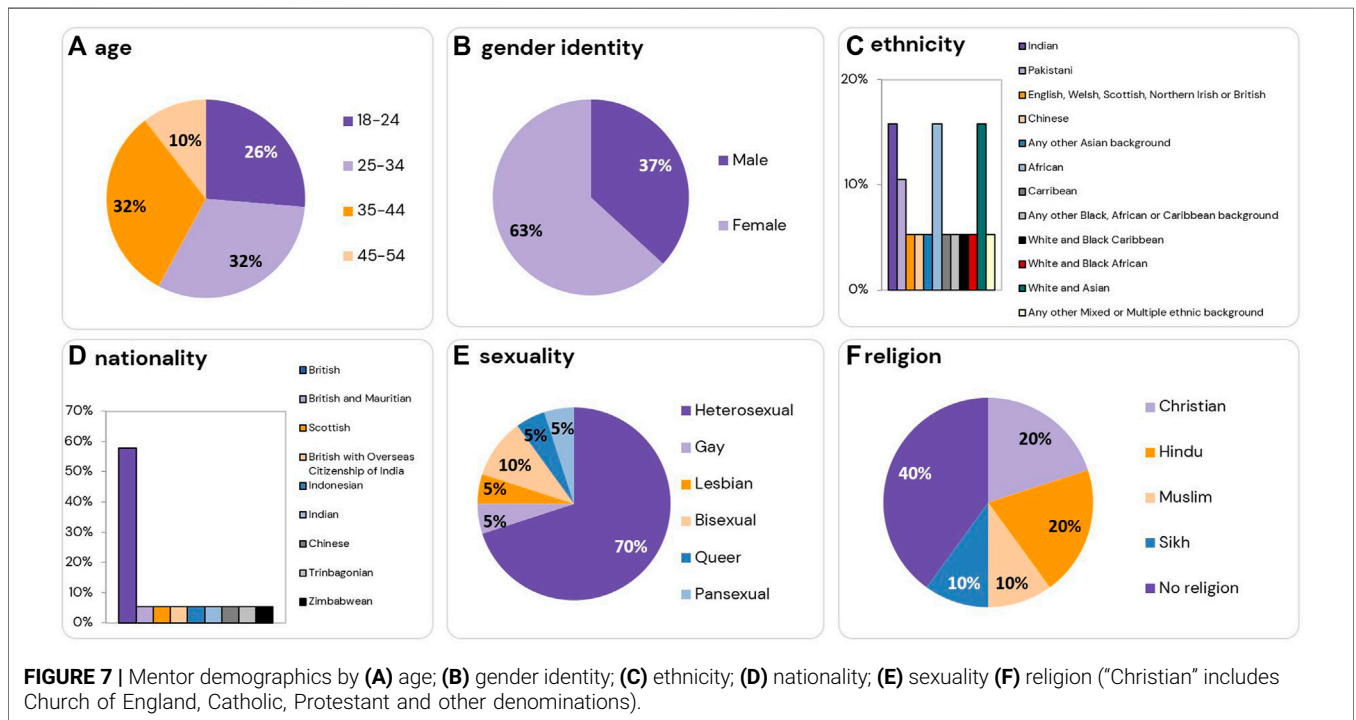


FIGURE 7 | Mentor demographics by (A) age; (B) gender identity; (C) ethnicity; (D) nationality; (E) sexuality (F) religion (“Christian” includes Church of England, Catholic, Protestant and other denominations).

The mentors ranged in age from 18 to 54, with approximately two-thirds identifying as female and a third as male. 95% of mentors identified as belonging to an

ethnic minority, with respondents belonging to a range of ethnic and religious backgrounds (Figure 7). Most mentors (70%) identified as heterosexual, with 30% selecting other

sexual identities. Most mentors identified as having no known disability or long-term health condition. Mentors described a range of titles/employment roles, with 10 aligned to Earth Sciences, five to Geography, and five to Environmental Sciences/Studies.

RESEARCH SCHOOL EVALUATION

The Research School is here evaluated against ToC project objectives.

Attitudes Towards the Research School

Before attending the Research School, participants were asked to rate the Research School programme based on how important each workshop would be to them. 80% rated the “conference and networking” event as extremely important, 70% rated “geoscience communication and building a public profile” as extremely important, and 50% rated “journal writing” as very important. 45% rated “PhD funding” as extremely important. One participant elaborated on the importance of conferences and networking;

“Conference and networking is the most important for someone like me, who doesn’t know anyone at all in this field or even related STEM fields”

Another participant responded that meeting people with more experience for guidance is vital:

“Meeting others gives others guidance and experience, ensuring the right academic and career choices are made with knowledge and this is quite a big deal and is an obstacle in career and academic progression”

Participants were asked what they would like to gain from the Research School in the pre-survey. Most of the responses were networking, gaining skills in science communication, grant writing and career guidance.

For comparison, in the post-survey, participants were asked to rank the Research School program in order of importance (with 1 being most important/useful) to gauge the differences in their responses after attending these workshops. Of the seven PhD participant respondents, three listed “networking during icebreaker, lunches and break times” as the most important to them, and two listed “grant writing” as most important. The “research conference day” and “preparing for an academic career sessions” were each ranked top by one respondent.

“The grant writing and fellowship information was priceless and by far the most valuable- from small grants to fellowship applications and the processes involved, criteria, common pitfalls etc. Everything had a benefit, but for me—the tips around how best to

pursue a career in academia and the associated talks-publishing etc were the most beneficial.”

The results from the Master/undergraduate students stream showed that “networking during icebreaker, lunches and break times” was ranked top by most respondents (50%). “How to thrive in your PhD and research career” (talks from recent PhD graduates), “science communication” and the “research conference day” were each ranked top by 15% of respondents. “The value of a PhD; transferable research skills” session was ranked top by 5% and second favourite by 20% of respondents. The spread of favourite workshops suggests that the balance of the programme was right and that there was something valuable in each workshop for most participants.

The participants were asked if there was any training they would have found useful that was not covered. The most common suggestion was a workshop on career and job applications outside of research.

Having considered overall attitudes towards the Research School, we now explore whether the school met the objectives of the Equator project.

RO1: Facilitation of Broader Networks

One of the goals of the Research School was to facilitate a broader community network and create a safe networking space for participants. In the pre-survey, when asked what barriers were holding back the participants from a research career, participants mentioned lack of guidance/support network, lack of minority ethnic role models, lack of representation in GEES, lack of finance, and knowledge of the sectors, skill development and uncertainties in career paths.

“A barrier holding me back from this career path at present is my lack of knowledge of the paths I can take as well as uncertainty regarding future prospects”

“The lack of representation of people who look like me in research”

The Equator team observed that participants quickly became a close-knit cohort, in part facilitated by the icebreaker, but predominantly (and spontaneously) during registration. After each day, the participants met for dinner and walks in the countryside (prompted initially by one of the Equator Project Team) and started LinkedIn and WhatsApp groups. The Equator team felt there was a very positive atmosphere throughout. One participant reported:

“We are all keeping in touch on WhatsApp and have created a LinkedIn group, so I am confident that the network will be useful in future. If this were to take place again, I would strongly recommend it to many of my contacts who missed out on a place this time”

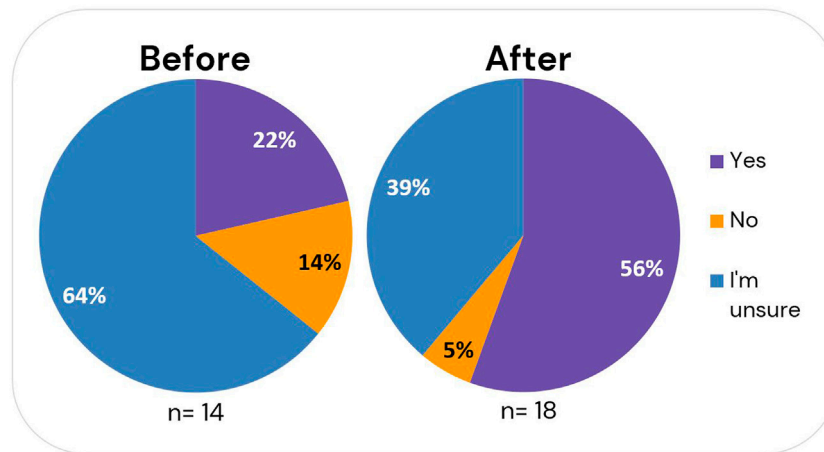


FIGURE 8 | Undergraduate/Master's level Research School participant responses to the question "are you planning to apply to postgraduate research," from surveys before and after the school.

Participants stressed the importance of networking with people from similar ethnic backgrounds, degrees, and research areas at the Research School.

"I found the research school very useful and gained so much exposure to people in the industry with similar background and experience, this is a very important thing and will definitely be helpful/ useful for me in the future and I am sure future participants will feel the same way too".

Overall, 85% of the participants felt the goal of having a broader network in GEES was accomplished, while 11% somewhat agreed.

RO2: Improved Awareness and Perceptions of GEES Research Careers

In the pre-survey, when asked if the participants planned on applying for a PGR degree following the completion of their undergraduate program, 21% of the participants said yes, 64% were unsure, and 14% said no. However, when asked a similar question in the post-survey, 55% of the participants answered yes, 40% were unsure, and 5% said no (**Figure 8**).

In the post-survey, the PhD stream were asked if they plan to apply for postdoctoral research positions and fellowships; 42% answered yes, and 57% were unsure. One participant said:

"I feel much more equipped to apply for research positions and fellowships"

One participant described how the school had equipped them with the knowledge of available funding for PhDs and commented on the network it had provided;

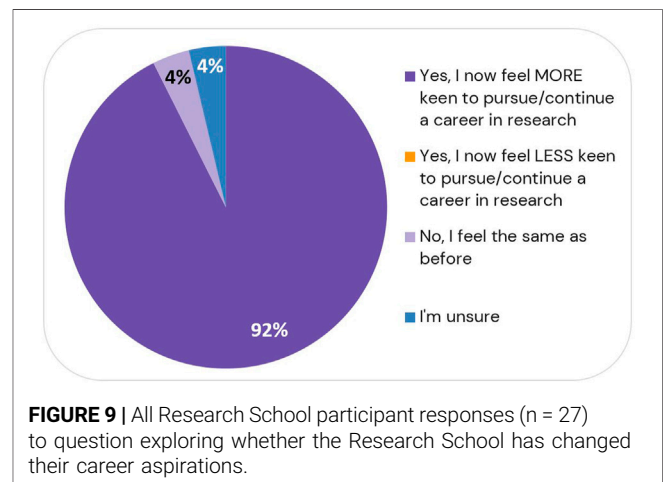


FIGURE 9 | All Research School participant responses (n = 27) to question exploring whether the Research School has changed their career aspirations.

"Financial burden of a self-funded PhD programme discouraged me to start that page. Joined the Equator Research School, I knew what funds could be applied. Also, my network in GEES research became broader after meeting school mates from various institutions and different level of studying"

Overall, most participants indicated they benefited from these workshops, with 92% of the participants agreeing they had improved awareness of GEES research careers.

80% of participants strongly agreed that they have a more positive opinion of careers in GEES research following participation in the Research School. When asked if the Research School affected their thoughts on a career in environmental research, 90% said that "I now feel MORE keen to pursue/continue a career in research" (**Figure 9**). One of the participants said, "This opened my eyes to PhD." Another participant said:

“The School was a great experience for me to learn a bit more about the challenges that ethnic minorities like me have to deal with in GEES subjects and to learn new insight on how to overcome these. It definitely has increased my interest in environmental research/PhD”

RO3: Increased Sense of Belonging

In the pre-survey, participants were asked about the barriers they felt might be holding them back from a research career. Some of the barriers mentioned were the lack of representation and not feeling a sense of belonging in GEES. In the post-survey, 78% of the participants strongly agreed to having an increased sense of belonging in GEES research and 19% somewhat agreed (**Figure 10**).

“I feel a sense of belonging as I have a network of people in the field”

Participants were exposed to potential role models from Black, Asian and minority ethnic backgrounds in GEES during the Research School. The team also facilitated a positive environment for interactions between the project team and participants, and incorporated a range of measures to build a collaborative and inclusive environment that contributed to an increased sense of belonging for the participants, e.g., social elements (group lunch/dinners and countryside walks). The participants also created a peer community and developed friendships outside the Research School. A participant said:

“It did not feel like a school even though it was run like one. the sessions were fun, very informative and inclusive and lunchtimes especially everyone including the speakers were mingling which made them very normal and approachable”.

This quote reflects the fact that the Research School involved elements of co-production, with knowledge sharing and a two-way learning experience between the Equator project team, speakers and participants.

Participants engaged openly and positively with their fellow participants and the Equator team. The fact that the workshops, group work and presentations were not credit-bearing, and solely designed to benefit the participants, may have contributed to this positive atmosphere. The majority had not taken part in similar initiatives previously; when asked if they had participated in ring-fenced initiatives before, only 10% said yes. One participant stated that they had attended a ring-fenced “application procedure for my CDT” and another had attended the “Natural History Museum Explorer’s Project Inaugural conference.”

When asked if they would attend future events related to the Equator project, 100% of the respondents said yes. Furthermore, 82% strongly agreed that the Research School was useful for them and 89% strongly agreed that they enjoyed the Research School and that it was well organised.

RO4: Improved Confidence in Moving Forward Within GEES Research

The Equator team noticed increased confidence in the undergraduate students throughout the week, noted in the following qualitative observations. At the start of the week, some of the undergraduates reported in conversations to the team that they felt nervous, particularly about participating in group work and giving oral presentations on the last day. However, they became more vocal during the “introduction to science communication” workshop as they were encouraged to work with each other. They were visibly excited to learn and seemed to become more comfortable when working in groups with other participants. During the week, they attended a workshop on “presentation skills,” and played word games together. The Equator team noticed the boost in their confidence when they applied their new skills in the mini-conference on the last day of the Research School, with each participant giving a five-minute presentation on a chosen topic of research interest.

“Before this research school, I didn’t have any confidence that I can have a career in GEES or do a PhD, mainly because I am from a minority group and never in my university career met someone doing a PhD or research who was just like me. This research school gave me so much confidence that I am worth it and that I can have a career in GEES research”

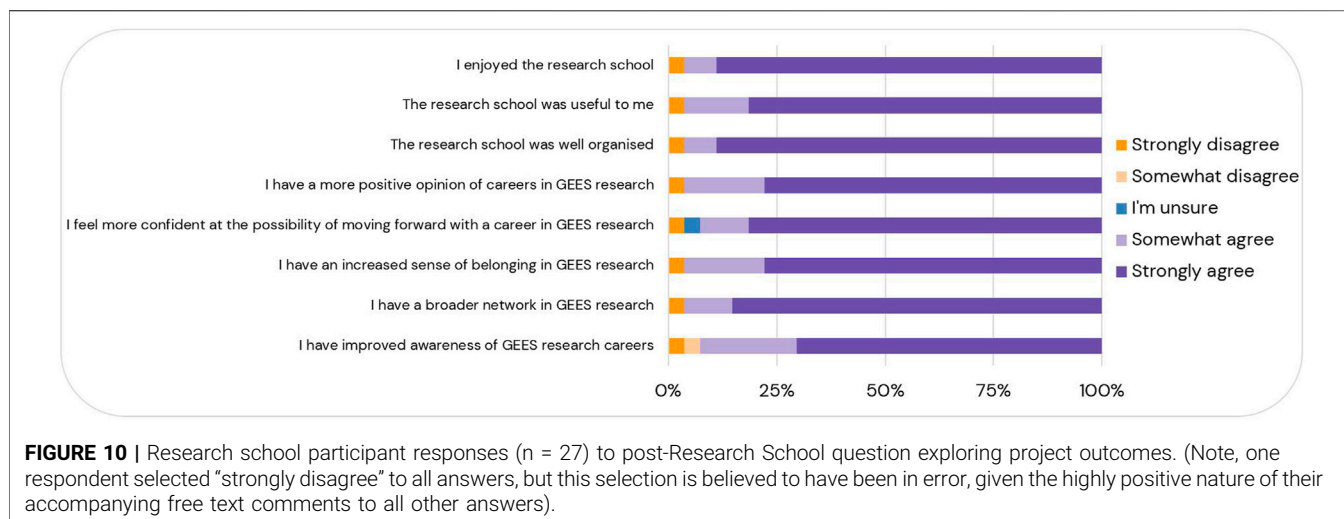
After the Research School, when asked if they feel more confident about the possibility of a career in GEES, 81.5% of participants strongly agreed, and 11% somewhat agreed, with one respondent exclaiming, “I just feel a lot more confident and supported!” Another participant said they feel even more confident now at the possibility of a research career in GEES;

“Yes, 100%, this school helped me get my confidence and my motivation/ambition back to pursue a career in research. Can’t thank enough to Equator team and other participants.”

Doctoral students in the PhD participant stream learned new skills during the Research School workshops that they could apply to their current studies and when progressing in their research careers. These skills were gained in workshops including grant and fellowship writing, journal publishing, open science, and “preparing for an academic career.” One of the participants said:

“I feel like there were some aspects of a research career that were highlighted to me during the research school which really made me think research was the right career for me”

The results from the pre- and post-school surveys, together with informal feedback provided in discussions during the school and via participant use of social media during the



week (see #EquatorResearchSchool hashtag on Twitter/X), clearly demonstrate a positive attitude change toward GEES PGR and research careers for the Research School participants.

MENTORING NETWORK EVALUATION

In this section, the Mentoring Network is evaluated against the ToC project objectives.

Attitudes Towards the Mentoring Network

The pre-Mentoring survey sought to understand what participants wanted to get out of participating in Equator.

Mentees were asked to rank a series of possible mentoring outcomes in order of importance to them. The most important outcomes to the mentees were setting and meeting goals/aims, and gaining resources and advice. These were followed by developing a mentoring relationship; confidence-building, and good mentee-mentor communication. Help with achieving a good work-life balance was ranked as the least important outcome. Eight of the ten mentees expanded on the outcomes of mentoring that were most important to them through free-text comments. Comments included themes of careers advice, peer-support, networking opportunities, and personal development:

“To hear about the experiences and potential struggles BAME colleagues have faced within GEES in the workplace and in academia.”

Prior to starting the Equator mentoring scheme, most of the mentors felt experienced in a range of mentoring skills, including active listening, giving constructive feedback, identifying and accommodating different communication styles, motivating a mentee, building a mentee’s confidence, encouraging a mentee to ask questions, and working

effectively with a mentee whose identity was different to their own. However, some mentors (10%–20%) felt “not at all experienced” in certain skills, including setting clear expectations of the mentoring relationship, working with a mentee to set goals, helping a mentee to develop strategies to meet their goals, and helping a mentee to achieve a good work-life balance.

When asked what they would most like to gain from the Equator Mentoring Network, the *mentors* were unanimous in their desire to offer help and support to their mentees:

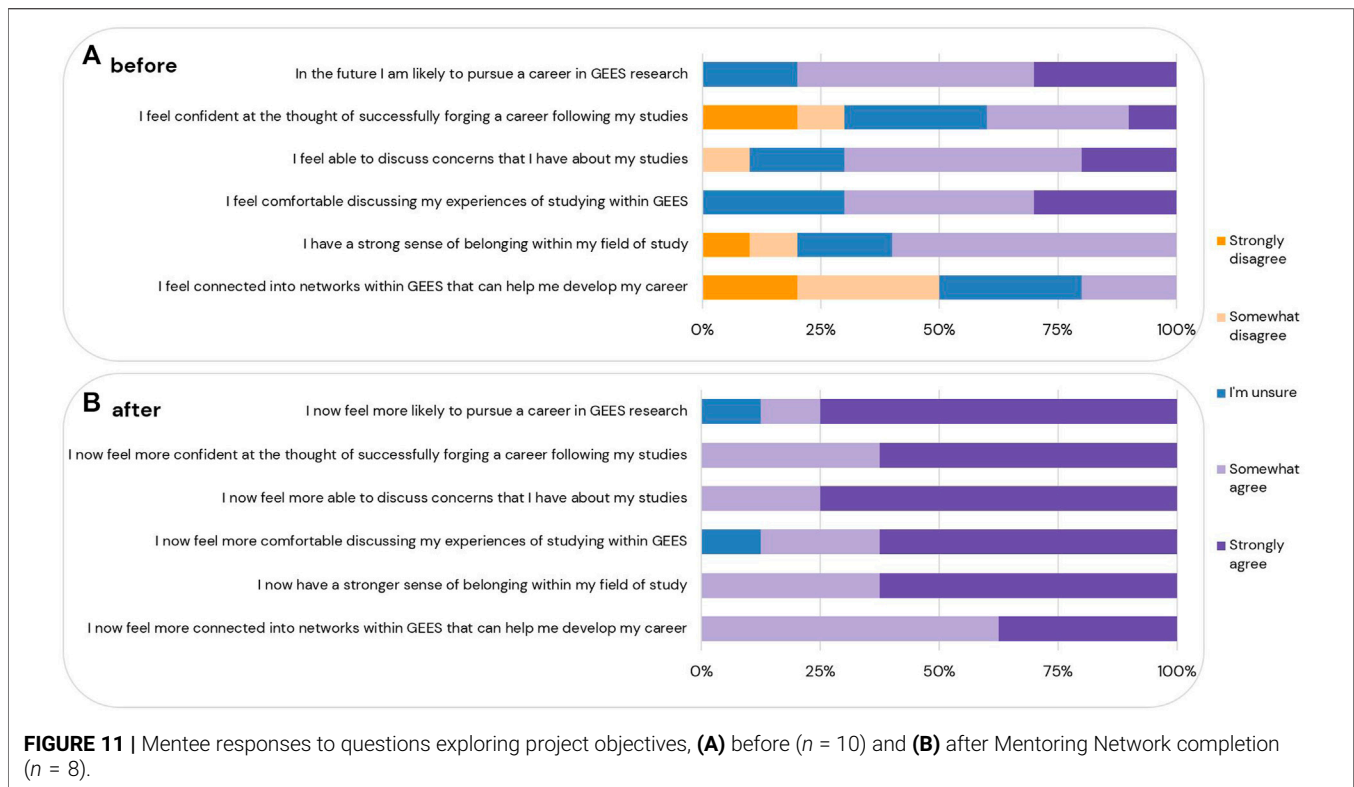
“My main motivation for taking part in this programme is to help others who may face similar challenges to myself, pursue a career in geosciences. When I was a student, there was no such mentoring scheme.”

“To help someone in a way I wish I’d been helped earlier in my career.”

Mentors were also hopeful that participation in the Mentoring Network would contribute to their professional and personal development:

“More personally, I would like to try and overcome some of the imposter syndrome I have when operating in academic spaces and gaining more confidence that I do have valid and relevant experience and knowledge of my field.”

Mid- and post-mentoring surveys indicate that, overall, mentor pairing worked well. 90% of the mentees rated how well-matched they felt with their academic and industry mentors as 7 or higher on a scale of 1–10, with 10 being most positive. All mentees felt comfortable talking with their mentors, which suggests that the pairings made were compatible and is an important consideration in building support networks within academic GEES.



Mentees' free-text comments from the mid- and post-mentoring surveys suggest that being assigned both an academic and industry mentor, a defining element of the Equator Mentoring Network, was beneficial:

"The most beneficial aspect of the scheme is being able to be matched with someone where you want to be, and gain insight into how to get there. It is difficult to connect to industry professionals on one's own, but through the scheme I have formed a great mentor-mentee relationship with someone who I greatly get along with, yet I may not have met nor had the chance to connect with without the scheme."

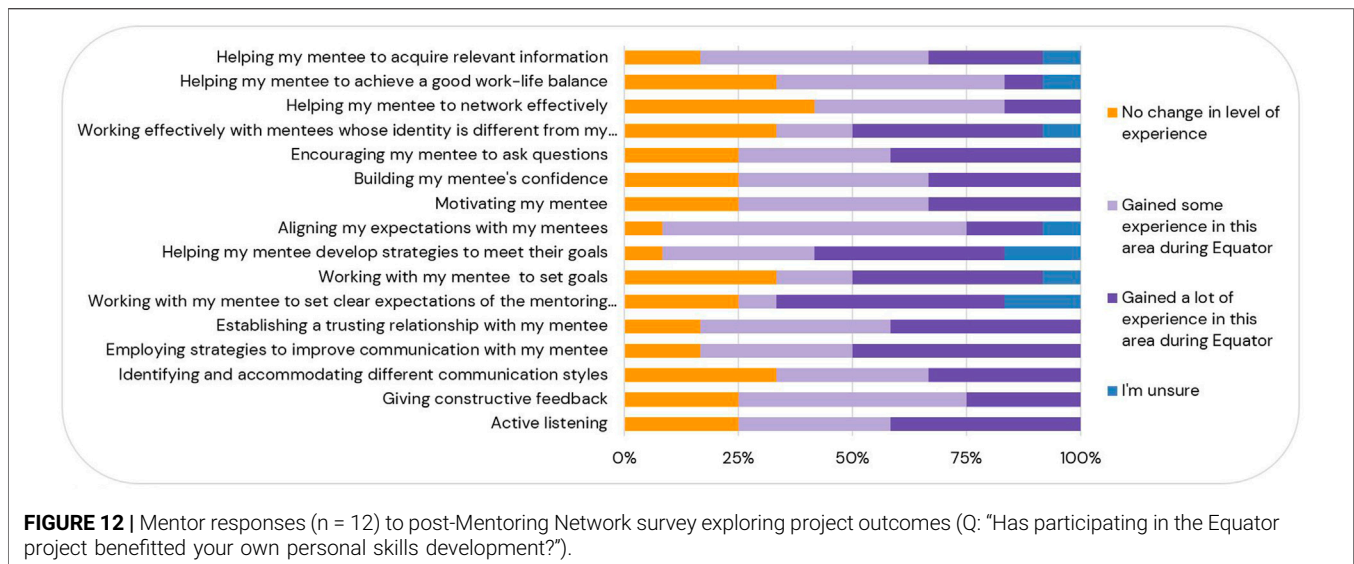
A mentoring onboarding/support session was provided at the start of the project for both mentees and mentors, and an approach was taken to encourage each pairing to develop a style of mentoring that worked for them. Mentors were positive about the network:

"Equator is very well organised. I enjoy that due to the organisation, it didn't take much of my time. Whereas when I do mentoring as part of my job and volunteer work, it takes tremendously more time to do it in a free-style way. I am planning to build a similar mentoring scheme focusing on my subject, thanks to the great example Equator had set. The matching between me and my mentee is brilliant. We will carry on doing it"

However, several mentors commented that additional guidance from the Equator project team or a mentoring "toolkit" would have been useful in helping to structure the initial mentoring sessions.

The mentees and mentors who completed the post-mentoring survey all indicated that not only would they take part in the scheme again should it run in the future, but also that they would highly recommend it to their peers. 100% of the 12 mentors who responded said that being part of Equator has made them more likely to be involved in ring-fenced mentoring in the future. Of the mentees who responded, all responded positively (rating of 7/10 or higher) when asked to rate their overall experience.

Mentees and mentors were asked what improvements they would like to see should the project, or similar schemes, run again in the future. Although overall, pairings seemed to be successful, some of the free-text mentee responses mentioned mentor selection. In future, in projects with more time allocation, more time could be taken at this stage and more information gathered about participants to help with pairing. Some mentors felt that greater assistance from the Equator project team with setting up the first mentoring sessions would have been helpful. Some suggestions for improvements focussed on increased opportunities for interactions between participants. The Equator project was constrained by project time and budget, but future schemes should aim to provide (and fund) more opportunities for mentoring networks to come together in person.



Having considered the overall effectiveness of the format and logistics of the Mentoring Network, we now focus on whether this intervention met the Equator project objectives.

MO1: Facilitation of Networking

The Equator Mentoring scheme aimed to help mentees to feel more connected to networks within the study via their mentoring contacts. All mentees who responded agreed that they now feel connected into broader networks in GEES, which may be of help in developing their career (Figure 11). One mentor commented that being part of the network was also good for them and the other mentors:

"Meeting with the other mentors in the scheme has been great, hearing their opinions and perspectives on why they are doing this and what they are gaining from it."

MO2: Improved Sense of Belonging and Inclusion

All 8 mentees who completed the post-mentoring survey agreed that they had a greater sense of belonging within their field of study after being mentored (Figure 11). One mentee explained that this was due to understanding that there are "people like me" on this same journey:

"I learnt that there are people like me who have been on the same journey as me, and it was just so reassuring to know that they're willing to help was great too."

The mentors also felt benefits to their sense of belonging by being involved in the Equator community:

"Feeling part of a community of motivated and similarly interested people, of making a difference and being able to help someone like myself but back in an earlier time when I would have loved such support."

In the post-mentoring survey, all respondents agreed that they now felt more able to discuss concerns (Figure 11). Seven out of 8 respondents felt more comfortable discussing their experiences within GEES. One mentee commented on the importance of shared intersectional characteristics with their mentor:

"I gained a fantastic relationship with my industry mentor, as she has provided a lot of great motivation, guidance, and support, almost being close to a mother or elder sister in a way. I am very grateful for this opportunity to have met her as I would not have had the chance without the EQUATOR network. Especially both being WOC [Women of Colour] I feel that she understands deeply a lot of things that not many people in my current environment do."

MO3: Build Experienced Mentors

Many of the mentors that took part in Equator had previous experience of mentoring and felt confident in their skills before taking part. It is therefore positive to see that even so, of the mentors who responded to the post-mentoring survey, many felt they had gained useful experience during the Equator project (Figure 12). The area where skills development was most strong was in helping mentees to develop strategies to meet their goals.

Mentors commented on how the scheme had contributed to their own continued professional development, and to their confidence levels:

“Working with my mentee also allowed me to feel confident. When I was able to provide advice and strategies for my mentee on questions for job interviews, this allowed me to see my growth and this made me feel comfortable with this mentoring project.”

MO4: Improved Confidence in Moving Forward With GEES Research

Prior to starting the Equator mentoring scheme, most mentees agreed that in future they were likely to pursue a career in GEES research, with 20% unsure. Most mentees (70%) agreed with the statement: “I feel comfortable discussing my experiences of studying within GEES,” with the remainder (30%) unsure. However, there was a large variance in responses in terms of future career paths, sense of belonging, being able to discuss concerns, and accessing support networks within GEES. When asked to expand on the responses, the mentees articulated a sense of enjoyment of their chosen subjects and clearly had ambitions to continue their studies, but lacked confidence or were uncertain about future career pathways in GEES research:

“I would love to have a career in GEES but I’m not sure how I can get it.”

When asked about present barriers to pursuing PGR in GEES disciplines, the mentees identified a range of challenges including unwelcoming academic climates, difficulties navigating academia, and a lack of support networks within academia:

“I feel like whilst I may have a queer POC [person of colour] support network outside of my degree, I don’t feel like there are people in my faculty that understand the struggles that come with having an intersectional identity, especially in a field where POC or queer people aren’t typically welcome or accepted.”

“I feel like I don’t belong to research society here. I think the problem is the big cultural differences between western and eastern, and it’s challenging to make friends with researchers. Another side of this problem might be that the research society is not inclusive.”

In the post-mentoring survey, all mentees who responded felt more confident at successfully progressing in their studies. Free text responses made it clear that the knowledge and skills gained during the sessions had improved their confidence:

“To gain insight about careers, conferences etc that others may already know was brilliant, feels like I’m not behind anymore”

“My mentors shared with me lots of valuable knowledge about interviewing, early careers, and

jobs. I also got support with my Master’s application that was very helpful in making that period of applying a smoother process.”

Seven of the eight mentees who responded agreed that they are now more likely to continue into GEES PGR than before being mentored; six strongly agreed, and one was unsure:

“As an individual I feel very empowered to undertake postgraduate research.”

“I realised that everything is possible, and I am good enough to be part of the GEES.”

This very positive outcome indicates that mentoring could be an important intervention in increasing applications from students from marginalised backgrounds for PGR degrees.

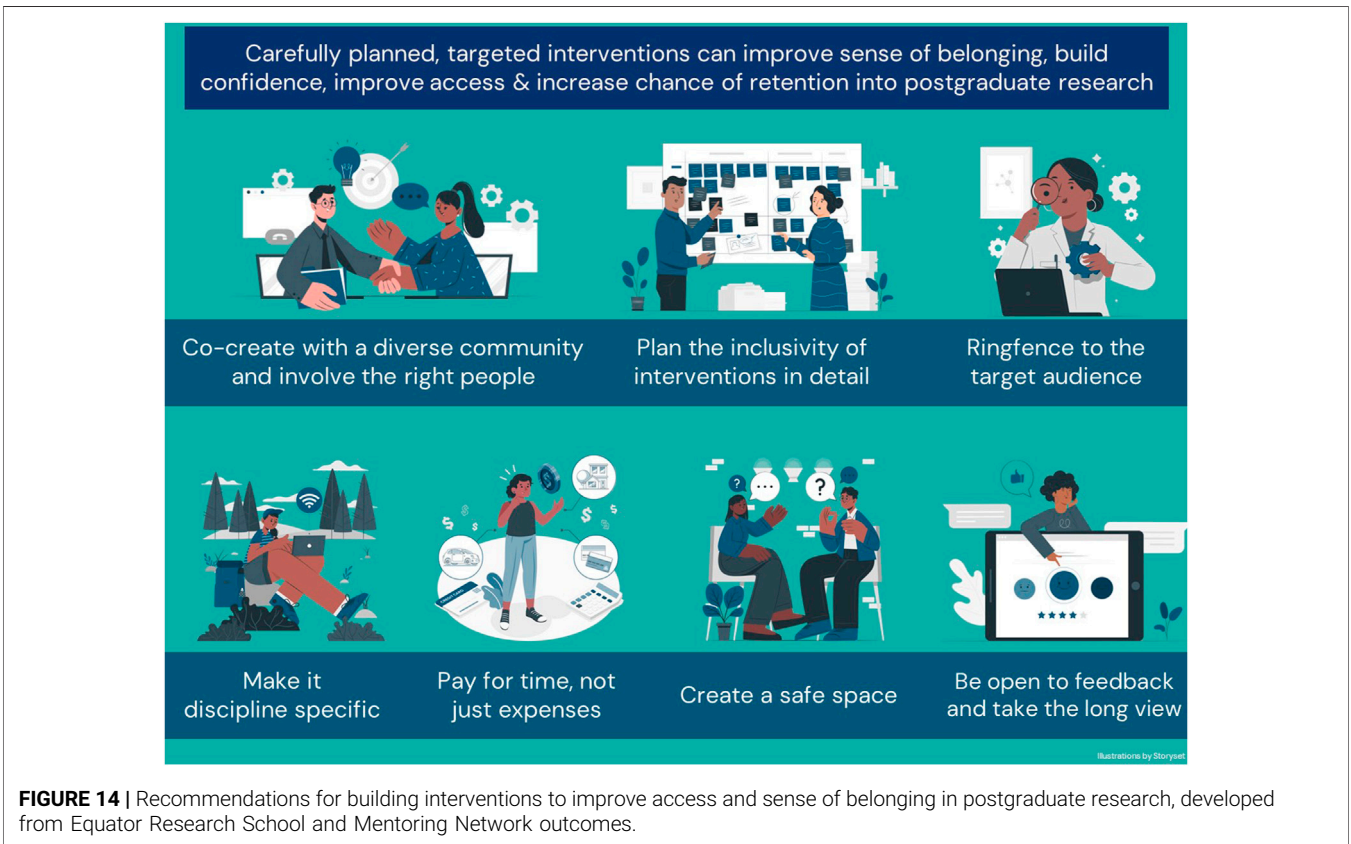
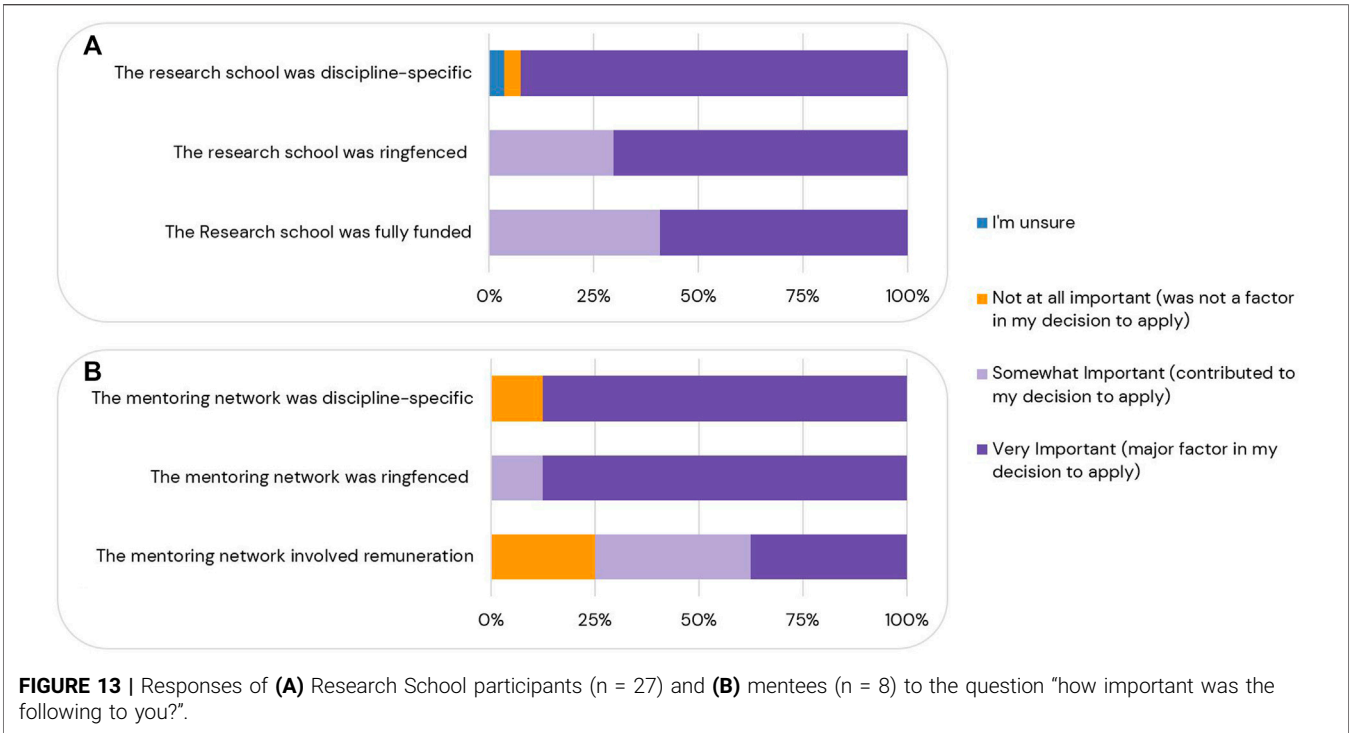
DOES RING-FENCING, REMUNERATION, AND DISCIPLINE MATTER?

These interventions were fully funded, ring-fenced for Black, Asian and minority ethnic students, and discipline-specific, a decision based on existing evidence indicating these as important factors in successful interventions (see Introduction). Our evaluation explored the significance of these factors for participants and found them to be very important (**Figure 13**).

The discipline-specific nature of the school was an overwhelming factor; 93% of Research School participants and 88% of mentees said that the intervention being discipline-specific was a major factor in their decision to apply. 100% of mentors who responded said this was important to them, with 60% saying it was “very important.”

Ring-fencing of the initiatives for participants from ethnic minority backgrounds was also a crucial factor; all mentees who responded said the ring-fenced nature of the scheme was important to them, with over 85% saying it was a major factor in them applying. The scheme being ring-fenced was “very important” to 75% of mentors. This speaks to the importance of providing a space for ethnic minority students to build a community amongst those with shared lived experiences. Unless ring-fenced schemes are designed to tackle EDI, those who need the program most may be further excluded.

The Research School being fully funded was cited as a “major factor in decision to apply” by 59% of participants. 75% of mentees said remuneration was important, with half of those indicating it as “very important.” Two-thirds of mentor respondents said remuneration was “not at all important” to them. This perhaps reflects that some mentors had employer support for their mentoring time; eight mentors chose not to be remunerated, and one employer contacted Equator directly to explain that they would cover the time their employee spent on the scheme. However, the fact that 12 mentors accepted remuneration highlights that it should not be assumed that time for outreach and mentoring is provided by all employers.



RECOMMENDATIONS

The recommendations presented here (**Figure 14**) are written in the context of Equator as a short-term project with limited resources and scope. Rather than being a conclusion, the team hope that these suggestions form a starting point for academics and leaders to open conversations and take action to improve equity in research.

Fund It. Ringfence It. Make It Discipline-Specific

Equator's evaluation indicates that provision of ring-fenced, fully-funded and discipline-specific opportunities to connect with mentors, develop networks and gain training are an effective method to increase participation and improve inclusion. Such efforts offer accessible and attractive interventions to those from marginalised groups who may otherwise be unable to take part due to financial considerations, caring commitments, or a sense of isolation. This evidence, together with previous efforts in this area (e.g., Dutt, 2019; Natural History Museum, 2022a), suggests that ring-fenced and discipline-specific schemes should be a vital part of centrally funded (e.g., Research Council and Office for Students) schemes to address disparities in research participation and outcomes. Funding can also be sourced through internal university schemes and external organisational sponsorship. The focus of funding should be on ensuring the continued provision of successful, evidenced schemes, rather than on a constant drive for novel interventions. In the United Kingdom, several ring-fenced opportunities and activities have been advertised in recent years (e.g., White Rose DTP and Stuart Hall Foundation, 2020; Leverhulme Trust, 2023; Sheffield Hallam University, 2023; UCL, 2023; CENTA, 2024; GAIA, 2024).

Co-Create and Collaborate With the Right People

Any intervention relies on the team, and the broader network of people, that make it happen. Co-production is understood to be a key feature of inclusive research, and careful consideration of whose voices should be listened to and experiences drawn on when designing interventions is essential (Holt et al., 2019). Recent NERC-funded interventions in geoscience (Quaggiotto et al., 2022; Fox et al., 2024; Holliman et al., 2024) demonstrate the effectiveness of thoughtful engagement with marginalised groups to understand barriers and improve inclusion. During Equator, discussions within the Project Team and Steering Committee of the steps needed, and the assumptions and risks involved, were critical to the development of our Theory of Change. We found that conversation and co-creation involving those with lived experience of the barriers being addressed, within different levels and across different sectors, was vital in ensuring our interventions were as effective as possible.

Feedback on the Research School demonstrates the importance of involving the right specialist speakers and mentors to be involved in an event, to help build networks that are so important to increased sense of belonging. The Mentoring Network feedback demonstrates the importance of mentoring and role models. Although the issue of low numbers of minority mentors and role models may mean that participants may not be able to hear from or engage with someone from their cultural or ethnic background (Thomas et al., 2007), efforts to ensure improved visibility of those with shared lived experiences should be central to the design of interventions. Such efforts have been central to GEES-related initiatives such as Fi-Wi road, the Explorers programme, and the GAIA project (Black Geographers, 2021; Natural History Museum, 2022a; Fox et al., 2024), and are also a key part of work to decolonise the geoscience curriculum (e.g., Rogers et al., 2022; Decolonising Earth Science, 2024).

Accessible, Detailed Planning That Creates a Safe Space

Once funding is secured, detailed planning is needed to ensure interventions are successful. This may include ensuring that venues are accessible to those from a range of identities, or that religious calendar timings are considered. It may involve considering whether preparations are in place to ensure all feel supported, and having back-up plans to consider a range of needs (e.g., Lawrence and Dowey, 2022). Sufficient time in advance of activities is also needed to ensure participants are informed, and feel prepared, to take part in the intervention.

By carefully defining codes of conduct, expectations and guidelines up front, participants are given a clear framework within which to engage. Ensuring that enough time is given for participants to engage informally with each other, as well as participating in formal elements of the intervention, is key. By involving the right people, informal discussions become important spaces for network-building, discussion, support and idea-sharing.

Give the Full Picture

Although the authors are not aware of GEES-specific data on doctoral graduate outcomes, it is known that typically, across academia, less than 50% of doctoral graduates will become employed within academia immediately after graduating and less than 10%–15% will have a long-term academic career (Vitae, 2016). Research is vital in a variety of sectors, but awareness of research careers beyond academia is often lacking (European Commission, 2019). Mentees involved in Equator appreciated being matched with both an academic and industry mentor, and participants at the Research School were very positive at the inclusion of materials on non-academic pathways. By sharing the full spectrum of possibilities in research, it is possible to build greater awareness, improve perceptions, and show futures away from the traditional structures of academia, within which some students may feel unwelcome.

Be Open to Feedback—and Do Something With It

By creating spaces for both formal anonymous feedback, and informal and continuous idea-sharing, participants are empowered and given a voice. However, it is essential to act on, and implement feedback, once received. During Equator, many participants and contributors were asked to contribute their time, energy and effort, as well as to provide feedback on how to improve future initiatives with an end goal of improving access and participation of Black, Asian and minority ethnic students in research. The Equator Project Team hope that this energy will not be in vain and will be used to contribute to change within GEES and beyond. We hope that future initiatives can learn from and build upon both the work conducted here and the feedback provided by participants to inform their actions (see Longevity and Future below).

Take Time, and Take a Long View

Improving participation cannot happen with rushed, poorly conceived, or badly executed interventions. Systemic, institution-directed efforts to fix hostile environments for marginalised groups are essential for improved equity in science disciplines (Laursen and De Welde, 2019). Equator only had 6 months' funding, and rapid delivery was necessary. The Equator team and Steering Committee was already in place to co-create the proposal, and key necessary partnerships and relationships had already been developed. However, more notice in advance of funding and a longer timescale on which to carry out activities would have allowed the project to have connected with other groups working on similar efforts, and to have engaged in continual knowledge-sharing and deeper forms of critical evaluation (such as focus groups) during the project. Permission was obtained from Equator participants to contact them in the future (see below), but longer-term EDI projects are essential to allow for longitudinal analysis as part of original project design (such as the long-lived US National Science Foundation's ADVANCE program; Laursen and De Welde, 2019).

SUMMARY

The first iteration of Equator worked with >60 students, mentors and speakers to carry out three targeted interventions. Monitoring and evaluation conducted before, during and after project activities shows that the objectives of the research were met. Participants overwhelmingly agreed that they had an improved awareness of GEES research careers, and that they broadened their networks, felt an increased sense of belonging, and had a more favourable opinion of GEES research careers. Our work underlines that the development of ring-fenced, discipline-specific initiatives is crucial in improving access and participation in GEES research careers.

The results from the pre- and post-Research School surveys, together with informal feedback provided in discussions and over social media during the week, clearly demonstrate a positive attitude change toward GEES PGR and research

careers for Research School participants. Participants had improved networks (RO1), improved awareness and opinion of GEES research careers (RO2), increased sense of belonging (RO3), and were more confident at the thought of taking up a career in research (RO4).

Based on feedback from mentees and mentors, through formal pre-, mid- and post-mentoring surveys and informal mid-project group meetings, it is evident that the Mentoring Network also achieved its objectives. Feedback demonstrates that the interaction between mentees at an early stage in their academic careers and mentors with established careers in GEES led to an increased sense of belonging and inclusion (MO1, MO2), and increased likelihood of retention into research (MO4). Equator mentees cited feelings of empowerment and improved confidence in continuing into PGR following the project. The majority felt more likely to pursue a career in GEES research due to their participation in the Mentoring Network. All Equator mentors reported improvements in their personal skills development as a mentor and felt that being part of the Equator Mentor Network had increased their likelihood of being involved in ring-fenced mentoring schemes in the future (MO3).

This paper reports the action research elements of Equator that were designed as interventions to help students overcome barriers to access, participation and retention in GEES. But ultimately, the system and PGR environment present the largest barriers. Interventions such as the Equator Research School and Mentoring Network should not be seen as an alternative to addressing structural issues, but as short-term actions that are highly necessary while long-term efforts to dismantle discriminatory practices and hostile environments are ongoing. The third Equator work package set out to address some of the broader structural barriers that result in inequity in postgraduate research. The findings are reported by Fernando et al. (2023), who share best practice recommendations for more equitable doctoral recruitment.

LONGEVITY AND FUTURE

The NERC-funded Equator project is being extended into a longitudinal study in spring 2024. Sheffield Hallam University research funding is enabling focus group analysis to track the viewpoints and experiences of our participant cohort 2 years after the original interventions. The work plans to investigate whether the initial successful outcomes reported here have created long-lasting impacts on participants' sense of belonging in research, and their progression into research careers.

In 2023, Equator team members at the University of Birmingham secured a successful replication of activity for "Equator 2.0" from Research England QR funding through the University of Birmingham, together with support from the BGS, the ARIES doctoral training partnership and the Central England NERC Training Alliance (CENTA). Equator 2.0 delivered a second iteration of the Research School (June 2023) and Mentoring Network (ongoing at the time of submission), with high numbers of applicants to the program.

The Equator 2.0 evaluation outcomes will be evaluated and disseminated in 2024–25.

POSITIONALITY STATEMENT

Equator is a research group working towards Equity, Diversity and Inclusion (EDI) in Geography, Earth and Environmental Science (GEES). This paper focuses on a 2021/22 Natural Environment Research Council-funded project that set out to improve access and participation of Black, Asian and minority ethnic students in GEES research. Of the seventeen authors of this report, seven identify as Black, Asian or minority ethnic. Although primarily geoscientists in academia, industry and the public sector, many of the authors have been involved in research and interventions related to Equity, Diversity and Inclusion (EDI) over the past 5 years, and/or hold EDI responsibilities in their respective institutions or charities.

DATA AVAILABILITY STATEMENT

The datasets presented in this study can be found in online repositories. This data can be found here: (Dowey, 2023).

ETHICS STATEMENT

The studies involving humans were approved by the Sheffield Hallam University Research Ethics Process (ER39312553). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

ND, CJ, RW, SG, AL, MR, and BF designed, coordinated, delivered and evaluated project interventions, and

contributed to authorship of manuscript. ND was Equator PI and led authorship of manuscript. JB, LB, EC, JH, AK, KM, GJ, FR, SR, and CS are on the Equator Steering Committee and contributed to project conception, intervention design, and manuscript review. LB and FR also contributed to intervention delivery. All authors contributed to the article and approved the submitted version.

FUNDING

The authors declare that financial support was received for the research, authorship, and/or publication of this article. The aspects of the Equator project presented in this paper were funded by NERC grant 2021EDIE004Dowey. Additional sponsorship to increase the numbers of Research School participants was received by the British Geological Survey.

CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

ACKNOWLEDGMENTS

Thank you to all Equator participants and speakers for giving their time, thoughts, feedback and trust to this project. We acknowledge NERC grant 2021EDIE004Dowey and are very grateful for additional financial sponsorship from the British Geological Survey (BGS). Thanks also to Nature Communications for donating Melissa Plail's speaker time to the Research School.

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