

DIVERSITY AND DISCOMFORT

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ABSTRACT

Equality, diversity and inclusion work within engineering education often focuses on gender. Gender underrepresentation having long been established as an inequality within engineering education. Many interventions have been undertaken to address gender inequity yet the change is disproportionately small relative to the quantity of studies, and work on other EDI areas is less frequent and effective. To examine why this might be the case, research was conducted using queer ethnographic interviews with 11 EDI practitioners within engineering education. The key barrier to EDI work was identified as discomfort of academic staff. It is hypothesised that this relates to misalignment between engineering disciplinary identity and skills associated with EDI work. Literature on educational theory identifies discomfort as a necessity for learning and social transformation, and as such, the future of EDI success in engineering relies upon supporting and enabling those experiencing discomfort to utilise it as a driver for equity.

Keywords: Engineering identity, positivism, diversity, discomfort

1 INTRODUCTION

Anyone who has walked into an engineering lecture will be aware of the gender disparity in engineering education. Due to this visible underrepresentation, discussion of gender in engineering has been prevalent for decades, particularly within Higher Education (HE). However, gender is not the discipline's only area of marginalisation; just the one most oft published about. This focus on gender, or on equality, diversity and inclusion (EDI) in general is depicted in *Figure 1*, which shows the findings of a Royal Academy of Engineering systematic literature review on EDI in UK between 2013 and 2022. Here the yellow and turquoise segments, by far the majority of the bars, are gender and EDI respectively.

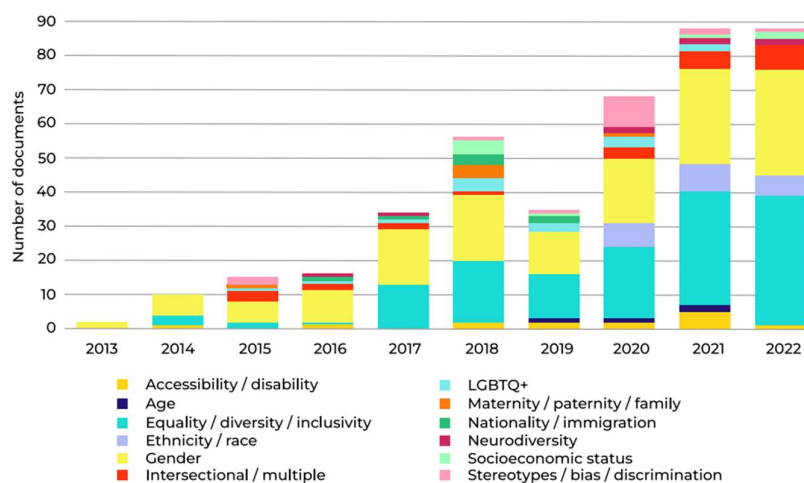


Figure 1. EDI in UK Engineering Documents over Time (Royal Academy of Engineering, 2023)

Furthermore, despite this focus on gender, the proportion of women in engineering in the UK has risen by only 6 percentage points in ten years (EngineeringUK, 2023), with similar findings globally. EDI though is more than just who is present in our classrooms, and whilst women may be severely underrepresented, racial equity remains a more divisive issue in terms of both degree awarding gaps (Codioli McMaster, 2021) and pay gaps (New Scientist Jobs, 2024). Beyond gender and race, EDI work

also encompasses disability, neurodiversity, sexuality, socio-economic status and many other elements, some of which are also visible in Figure 1. All are covered, to a greater or lesser extent, in this research. The research presented in this paper is part of a larger piece of work which examines the focus on gender, using this as a comparison point to explore why other areas of underrepresentation and inequity in engineering education have received less attention. The study interrogates whether the focus on gender relates to the prevalence of women carrying out EDI work in engineering education, with the research question “What is the nature of the relationship between EDI initiatives in Engineering Education, and the positionality of the EDI practitioner?”, looking at approaches to EDI work rather than at the structure of efficacy of the interventions themselves. The research is on-going, and too large for a conference paper, as such, this paper uses the wider body of research to ask, “What is the key barrier to EDI work being more widely and equitably adopted within engineering education?”

2 METHODS

Given this research is about underrepresented communities, and the demographics and characteristics of those conducting EDI work within engineering education, the research needed to use methods designed to amplify marginalised voices and examine identity. As such, Queer Methods were selected. Queer Methods grew from Queer Theory, which itself arose from lesbian, gay and gender studies in the 1990s (Brim & Ghaziani, 2016). They are recognised as being reflexive and dynamic and have been adopted within Social Sciences to move away from historic over-reliance on positivism (Browne & Nash, 2016), but are relatively new to engineering. This shift from positivistic to interpretivist approaches, through the use of Queer Methods, represents both a challenge and an opportunity for engineering education research. By using recognised methods and tools, i.e. Queer Methods, and the Wheel of Power and Privilege, within the research, a trusted framework enables new boundaries to be explored.

The research, approved by the Imperial College London Educational Research Ethics Panel, involved 11 participants from across the UK and US, all of whom were staff working within HE in engineering (or who have recently done so) and who self-identify as EDI practitioners. Participants were specifically selected to give a range of different demographics, backgrounds and institutions, mitigating the impact of small sample size. Each took part in a 1-1 queer ethnographic interview, including a set of 5 semi-structured discussion themes, and 2 activities which included critiquing and annotating images, one of which was the Wheel of Power and Positionality (Duckworth, 2022). An in-depth discussion of Queer Methods and the specific approaches used in this research is available in a prior paper (Agg, 2025). Annotation of the Wheel of Power and Positionality (henceforth WPP) also enabled nuanced collection of demographic data. A collective map of participant and researcher positionality, mapped onto the WPP is visible in *Figure 2*, with each line representing a participant with that characteristic. This shows our participants as being predominantly white, with post-secondary education, able-bodied, heterosexual, neurotypical, with mostly stable mental health, average body size, owning property, middle class, native English speakers with citizenship in the country they were living. Most characteristics had some representation outside the “norm,” and gender approached an even split:

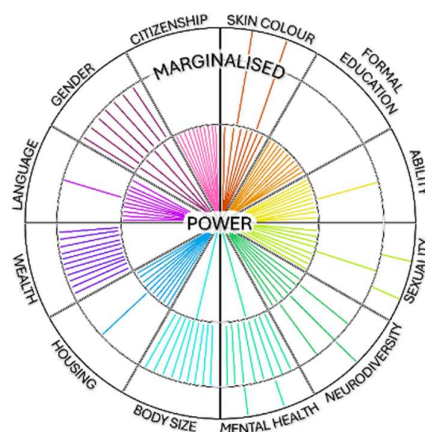


Figure 2. Wheel of Power and Positionality Mapping Participant Positionality

3 ANALYSES

The data included 14 images provided by participants, 11 annotated WPPs and almost 150,000 words from 11 interview transcripts. Only the data from transcripts were incorporated into the coding analysis, with the other data being present to support the reflective process of the interview as well as provide clarification of understanding for both participant and researcher. Transcripts were read several times, including reviewing the images and positionalities of participants, with notes being made throughout the process in order to arrive at a consistent and rigorous coding approach. An abductive approach was taken, using sensitising concepts to support the creation of codes. Sensitising concepts is a long-standing approach used in qualitative research (Blumer, 1954), particularly in ethnography (O'Reilly, 2009), to build upon existing theory whilst remaining open to the nuance of individual perspective. The sensitising concepts used came from the research's framing concepts including Freire (Pedagogy of the Oppressed, 1970), Merriam (Power and positionality: negotiating insider/outsider status within and across cultures, 2001) and De Zoysa (Motivation and the Role of Empathy in Engineering Work, 2024). Coding the transcript data resulted in 152 initial codes, which were then grouped into a set of themes and "regions", illustrated in **Error! Reference source not found.** and **Error! Reference source not found.**;

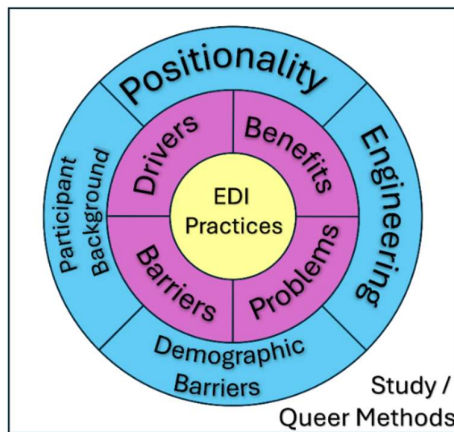


Figure 3. Coding Framework – Themes

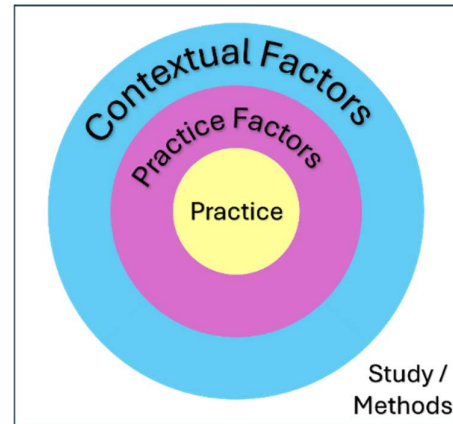


Figure 4. Coding Framework - Regions

Transcripts were coded manually using Nvivo, with segments often being assigned more than one code, for example in Figure 5, on the left Iretioluwa talks about why she started running a Headstart outreach and on program, with the coding stripes shown on the right, relating this to EDI Drivers/Own Background, Student Staff Barriers/Ethnicity, Student Staff Barriers/Class or Wealth, and Problems from EDI work/Lack of Belonging.

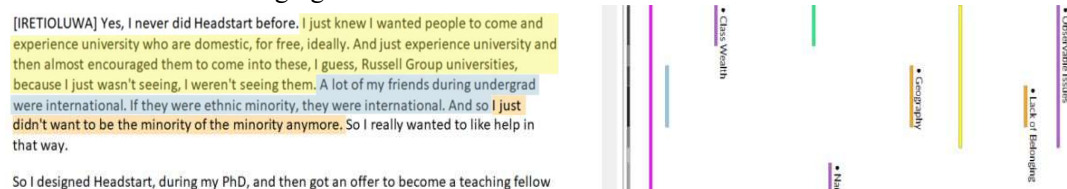


Figure 5. Example coding segment

4 RESULTS

As can be seen from the coding framework, barriers were a significant discussion topic, occurring both at a practice level and at a wider contextual level. Within EDI practice, barrier related codes occurred 486 times, as compared to 197 driver codes, 74 benefit codes and 34 problem codes. Within the practice related barriers, discomfort was the most prevalent code, occurring 31 times, with leadership/authority, resources/money, systems/rules and knowledge all having 25-27 occurrences. Codes relating to discomfort also featured, such as fear (20 occurrences), confidence (13 occurrences), tension (12 occurrences) and vulnerability (8 occurrences). Discomfort of participants colleagues in particular was a deeply discussed barrier to EDI progress as anonymised participants Chris and Iretioluwa illustrate;

“so some of that recalcitrance is that we can't call out because people are so uncomfortable with the idea of being called racist.” [Chris]

“Chloe: Why do you think there is that resistance from staff?

Iretioluwa: I think it's the embarrassment of the conversation.” [Iretioluwa]

Participants also raised concerns about the backlash of people in positions of privilege who have been made to feel uncomfortable:

“inherently there's going to be minority groups and resentment of minority groups if those that are uncomfortable to change are having to change and are identifying a small number of people as to why they need to change” [Toby]

EDI practitioners have also experienced the same discomfort as colleagues, but have either passed through it, or learnt to live within it and channel it to productive use. Below, Emily talks about her historic naivety, before her personal journey as a practitioner. In this quote the discomfort she has experienced on this journey is visible, perhaps enabling empathy for colleagues avoiding of EDI related discomfort:

“sometimes I wish I didn't do that reading and critical reflection because it opens your eyes up to all these things that were never an issue to you and now are. Obviously, I don't wish that.

But, you know, like you can see that sometimes life [was] simpler.” [Emily]

Some participants viewed colleagues' discomfort around EDI work, and to an extent their own personal barriers as well, as something stronger, pushing into being fear:

“before, you might get an email, but now they'll [students] find a forum, and they'll make sure it's like broadcasted widely as to why they're so upset with you. So if they could do that on like a mistake you made on a module, on a slide, right? What will they do if you've done something else wrong? You know, so it's that idea of, actually, let me not do anything, as opposed to trying to keep making a positive impact in all the spaces. Because I think there's a genuine fear on the NSS, student satisfaction, office students, students complaining, there is genuine fear of it.” [Iretioluwa]

Where this fear was being experienced by the participants, rather than by their colleagues, they also talked about having come through to the other side of fear, enabling them to take positive action:

“I think fear sometimes is probably the thing that hasn't gone as well. I'm less fearful now of getting things wrong because actually I'm now approaching it from a place of, well, I'm still learning. So, I want to ask questions because I want to learn and if I put my foot in it then I'll apologise profusely but I'll never do it out of malice and I don't intend to come across as being a nasty person so I'm probably okay. But I think, yeah, things that haven't gone well have usually not gone well because I've not felt comfortable asking the right question to find the information, I needed to make sure something was treated correctly.” [Elizabeth]

One hypothesis for the source of this discomfort associated with EDI work is that it arises from the clash between the traditional nature of engineering work, being a hard, quantitative subject, and the perceived nature of EDI work as being a soft, qualitative subject. This hypothesis builds upon discussion in engineering education research around the hyperfocus of engineering on quantitative data and reliance on existing hierarchies (Pawley, 2019), as well as the well-defined disciplinary identity of engineering as “hard” (Becher, 1989).

By contrast though, the participants generally have the same, or similar, academic background to their non-practitioner colleagues, and are compelled to create change rather than being prevented from doing so by their discomfort. The participants have all experienced discomfort through being marginalised and are therefore potentially more able to work within it, a skill which comes from their marginalisation and is something to celebrate. Participants have all reflected upon their own marginalised identities, and thus their discomfort has been transformative rather than preventative. This relates to Vygotsky's zones of proximal development (1978), which requires transformational crisis to move from one zone of development to another. Whilst originally focused on childhood development, this model has since been applied to learning in many settings so is likely applicable here. Certainly the participants exhibit the transformational crisis Vygotsky deems necessary for learning, as demonstrated in these quotes from Chris and Elizabeth:

“I think because, and we've talked about fighting all the battles. I think over the last, definitely three or four years, my positionality has changed. I think meeting, knowing, and understanding the lived experiences of different people has changed the way I see the world.” [Chris]

“I’m thinking timelines in my head of when I’ve had support and when that fear has then gone away. And they do link, actually, that having become a more confident, kind of calm person in myself, that journey of going to there has actually banished a lot of the fears. Because, partly because of who I am now, but also partly because there might be loads of other people who don’t know how to speak up about those things. And if you go in there and go, okay, yeah, nothing’s off the table, hopefully that will help. And I think it has helped.” [Elizabeth]

Building on Vygotsky’s zones of proximal development, Boler and Zembylas talk about “zones of discomfort” (Boler & Zembylas, 2003). These zones are part of the pedagogy of discomfort which is seated within social justice, focussing on changing of dominant practice and power hierarchies requiring both students and teachers to step outside of their comfort zone in order to enable a move towards equity. This pedagogical approach aligns closely the findings of this study, identifying that discomfort is a requisite component of change in the context of EDI and social justice, as well as crisis being essential for transformational learning. This conglomeration of crisis and discomfort for change and transformation also closely ties in with Queer Methods, which should be socially transformative, yet requiring destabilisation.

A notable caveat is that this research has thus far only interviewed EDI practitioners, so this interpretation of the barriers to other staff taking on EDI work is from the perspective of EDI practitioners, not from the perspective of staff who are being discussed. However, the recurrence of colleague’s discomfort, fear and disinterest through the interviews shows that this is a common theme experienced by EDI practitioners when working with other academics. Further research is needed, with non-EDI focussed engineering education colleagues as participants, to verify that this interpretation is correct. However, given the strong relationship to the well-established literature, and the expertise of the EDI practitioners it is a reasonable working assumption. Furthermore, staff who are not doing EDI work are less likely to engage in studies on the subject, and less likely to answer honestly if they did; admitting to fear, discomfort or a lack of skills being a challenge in itself. Therefore, EDI practitioners’ perspectives are a pertinent proxy in this case.

In terms of translating research findings into action, participants viewed their currently disengaged colleagues as an essential component to the future success of EDI in engineering. Here Dave identifies with civil rights movements, and the need of persuading the majority to change:

“you know as in all civil rights movements invariably it’s only when the minoritised have support of at least an element of the majority that change really ever happens. That’s how it got like that in the first place, because one group had power and one didn’t, it’s not until the group that have power are persuaded to change that it moves on” [Dave]

5 CONCLUSIONS

In asking “What is the key barrier to EDI work being more widely and equitably adopted within engineering education?” this paper finds that, engaging with EDI work induces discomfort in engineers. This appears to be caused by the prospect of moving away from traditional scientific comfort zones, which align with the “hard applied” territory of engineering disciplinary identity. This discomfort is amongst the greatest perceived barriers to successful and on-going EDI work. EDI practitioners are able, to some extent, to tackle these barriers by drawing upon their own positionality which is a source of strength, with marginalisation, empowering their empathy, authority and anger over inequity issues. Discomfort, it appears, can be both a barrier and a driver to action on EDI depending on a person’s access to reflective learning, and support to move outside of their comfort zone.

As it currently stands, EDI work is an act of rebellion. Not necessarily intentionally, nor radically, but inherently. EDI work looks to change systems away from the traditions of decades and centuries, it invites in people who have never been represented as holding power in engineering classrooms. When looked at on this scale, it is no wonder that it has the potential to cause discomfort. EDI practitioners however are fuelling this work through their difference from existing norms; they are already the outsiders and are thus well positioned to be the rebels. Though these acts of rebellion are initially intimidating or uncomfortable to undertake, EDI practitioners find them to be rewarding, and a source of pride. The challenge then is how to support others through their discomfort; to offer them opportunities to share the joy of EDI work through breaking a few rules or “norms” themselves, and to learn and reflect in the process. Historic methods have been ineffective and have relied upon data and focused on gender. As Audre Lorde says, “the master’s tools will never dismantle the master’s house”

(Lorde, 1984); if we want to dismantle an inequitable system we must use different tools such as queer methods, and be prepared to experience discomfort as we collectively transition from one zone to another.

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