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Inclusive excellence in STEM higher education

Camille Kandiko Howson and Martyn Kingsbury

Introduction

Inclusive excellence is about more than widening participation, going beyond issues of outreach and access. It is more than changing who gets in, it is also about changing what they get into. To be truly inclusive in higher education we need to change who we teach, how we teach, what we teach and who teaches. Doing this well extends the principles of inclusion to redefining excellence: part of being excellent is to be inclusive. This chapter draws on research and evaluation of a strategic, institution-wide approach to embedding diversity and inclusion at Imperial College London, a research-intensive science, technology, engineering and mathematics (STEM) university. This chapter highlights the need to integrate identity and belonging in order to support inclusive excellence. It covers four case studies that support inclusive excellence through staff, students, the curriculum and the wider student experience. These case studies of institutionally funded research and evaluation projects provide insight into how inclusive excellence as an idea can be operationalised in practice.

The chapter challenges stereotypes in STEM fields and students' disciplinary identity. Similar beliefs exist about staff roles and responsibilities in STEM disciplines. The reality is much more complex, and there is a need to embrace wider views of who is part of STEM higher education, and how STEM communities can be more inclusive. Two of the case studies explore longitudinal approaches to researching belonging and identity in STEM higher education. Interviews with staff and research with students show that interactive pedagogies require a new focus on

student identities and responsibilities, and on staff identities and roles. This focus brings prestige for educational expertise, new ways of staff and students coming together in disciplinary contexts, and fresh insights into intersectional identities. Two further case studies, one on lessons in belonging from sectors outside higher education and another on using a 'kitchen' model for introductory laboratory skills in chemistry, provide fresh insights and detail new pedagogical approaches to making STEM education more inclusive.

This research addresses more widely how belonging is an affective outcome of student and staff experiences, and not something that can be forced or imposed. Lessons are offered in how academics, teaching and professional services staff, as well as students, can create environments in which multiple identities can be supported and which offer opportunities for transformation for individuals within STEM fields. Experiences from sectors beyond higher education can provide insights into how such aims are realised. This chapter explores new and innovative pedagogies that integrate research and teaching, challenge what STEM is, and explore what it is to belong in a STEM environment and how belonging can be supported within institutions. This approach involves reconceptualising success in higher education, and incorporating wider indices which embed inclusion as an essential aspect of excellence.

From widening participation to inclusion

Selective higher education institutions have implemented a range of measures and initiatives to address calls to improve diversity and inclusion but, despite significant regulatory and market pressure, have struggled to achieve the impact expected given the level of investment and effort (Buitendijk et al., 2019; Millward, 2021). STEM fields have lagged behind, compounded by gender gaps in access and progression that have been managed successfully across higher education more broadly. With students from across the globe competing for entry, highly selective institutions have focused on cautiously diversifying intake (Tight, 2012), taking great care to mitigate any perceived or actual impact on standards and outcomes (Boliver, 2017). Older higher education institutions with historically established identities face an additional challenge, with cultural and historical inertia often resisting well-intentioned change (Boliver, 2015). These findings align with research suggesting that those who have benefited from higher education are hesitant about opening its possibilities to more of the population (Mountford-Zimdars & Sabbagh,

2013). In higher education, social inequalities have persisted, and many gaps have widened despite extensive policy rhetoric and institutional investment (Bathmaker et al., 2013; Dorling, 2015). Higher education needs to be seen as more than an instrumental good, incorporating the experience of attending higher education in addition to the degree credential it provides (Kromydas, 2017).

Recently, greater attention has been devoted to enhancing the experience of students already enrolled, with the aim of reducing progression gaps and improving outcomes and retention (Office for Students, 2018). Concurrently there has been a greater emphasis on improving mental well-being and addressing untalked-of problems such as an overly competitive culture among both students and staff (Atkinson 2021; Kerr, 2013). To stay competitive, higher education institutions must consider and invest in the wider student experience. How institutions retain their reputation and standards is an area of concern, especially as student, staff and regulatory definitions of what is excellent, and therefore what its various members expect from the institutions in question, continue to evolve in the light of the changing higher education landscape. Similarly, making STEM inclusive requires that both access and continuation be tackled, and addressing stereotypes that inhibit belonging and impact outcomes.

Inclusion and research on the student experience

With stereotypes abounding, it can be challenging for higher education institutions to get a sense of the student experience across the institution. This difficulty is compounded in devolved, research-intensive institutions where there are high levels of departmental autonomy and many staff and students' allegiance is to their discipline. However, increasing regulation and oversight of higher education, a strong feature in higher education in England, requires the student experience to be reported and evaluated at an institutional level.

Longitudinal research not only provides data to fulfil institutional reporting responsibilities; it can show, too, how the student experience is changing over time, in response to institutional initiatives and strategic plans. It can also provide insight into societal influences such as a cost-of-living crisis and global events like the Covid-19 pandemic, and how these impact on students. Such impacts disproportionately affect disadvantaged students, which provides a further incentive to understand how all students, not only the majority, are faring. Such institutional approaches

can range from undertaking longitudinal qualitative projects to adding a few questions on belonging to existing institutional surveys (see Kandiko Howson and Kingsbury, [Chapter 1](#) in this volume, for examples), or to analysing existing data through a belonging lens. The following case study provides an overview of several institution-wide research and evaluation projects that offer an institutional lens onto belonging and the students' experience.

Case study: longitudinal, institution-wide research on students' belonging

The Belonging, Engaging and Community (BEC) Project ([Centre for Higher Education Research and Scholarship, 2023](#)) started in 2019. It investigates how students understand and construct their own sense of belonging to, and engagement with, various potential communities. The project draws on multiple methodologies to explore students' belonging, including questionnaires and semi-structured, longitudinal interviews, as well as more innovative approaches to capture unique insights, such as walking interviews and vox pop interviews. Outputs from the project include reports on how students' sense of belonging is mediated through pedagogy and the curriculum ([Cohen & Viola, 2022](#)), and using civic scholarship as a lens into how students develop as global citizens in a multicultural institution. These findings challenge stereotypes and assumptions that STEM study is 'neutral', and show how students are impacted by societal and political events ([Viola, 2021](#)).

Two projects, including an annual survey and qualitative research, explicitly focus on the experiences of students who are in receipt of an institutional bursary. As well as enabling the institution to evaluate the bursary scheme, these give an opportunity to students predominantly from widening-participation backgrounds to express their views on their experience. Breaking down stereotypes, this research has demonstrated the resilience and self-efficacy of these students, but has also revealed some of the financial and social challenges. The BEC and bursary projects are complemented by an annual institution-wide Student Experience Survey, which gathers feedback on a range of College services and the Imperial College Union. Questions on belonging show departmental differences, which signifies the need to be sensitive to local cultures and structures when addressing institution-wide challenges.

These research and evaluation projects provide huge insight into students' experiences, their sense of belonging and the communities they

feel part of – or excluded from. Going beyond a single data source, these findings can be brought together to target specific pockets of concern and to add nuance to debates about ways to address stereotypes of STEM students. Such research also provides data to enable evidence-informed institutional decision making. This was recently seen in the development of an institution-wide mental health and well-being strategy, which aims to help staff and students to feel part of a wider, single, integrated community.

Diversity and inclusion

In UK higher education, diversity became a key feature of New Labour's widening-participation drive ([Department for Education and Skills, 2003](#)). Archer (2007) argued that this embracing of student diversity conflates equality and social inclusion, obscuring economic rationales and broader social justice critiques of the sector. This widening participation policy shift focused on changing the attitudes and aspirations of those who do not participate in higher education ([Reay et al., 2001](#)) rather than on addressing institutional cultures and practices. Diversity and inclusion thus sit precariously within higher education, as a policy 'solution' and an institutional 'problem' to be addressed. Diversity and inclusion also began to emerge as a key pedagogical tool, focusing on meeting the learning needs of all students ([Grace & Gravestock, 2008](#)). Over the past two decades, equality, diversity and inclusion agendas have been both promoted and decried; current manifestations of the debate relate to culture wars, decolonisation and charges of 'wokeism'. The policy debate continues on notions of equality, equity, and how meritocracy is defined ([Boliver & Powell, 2023](#)).

Inclusive excellence has emerged as a key response to the cultural resistance exemplified by these manifestations. Inclusive excellence is an effort to redefine the standards that those in a higher education institution work towards by including an inclusive environment and culture as a dimension of excellence. This approach aims to broaden notions of quality and avoid the idea that there is a trade-off between quality and widening participation in higher education. In contrast, widening participation should be seen as a way of increasing quality through a diversity of inputs, talents and experience, and wider notions of success.

Inclusive excellence frameworks have been widely adopted as a way to embed equity, diversity and inclusion policies in universities in the US and the UK. 'Making excellence inclusive' is a guiding principle for the

Association of American Colleges & Universities (AAC&U, 2021), with an associated Equity Scorecard and Diversity Toolkit. Pursuing inclusive excellence means that inclusion is a requirement of excellence and of redefining notions and criteria of excellence. Beyond merely admitting students from a wider range of backgrounds, inclusive excellence is about creating an environment in which all students can thrive and exercise their diversity in a way that mutually benefits the whole community.

Stereotypes in STEM

Stereotypes about STEM impact staff and students' identity and sense of belonging, as well as progression and outcomes. Popular media representations of STEM professionals range 'from mad scientists to absent-minded professors to brilliant geniuses to maniacal villains to socially awkward loners to life-saving heroes' (Steinke, 2017, p. 1). Gender stereotypes about STEM are societally entrenched; the common perception is that boys are more interested than girls in engineering and computer science from as young as six (Master et al., 2021). In a study that covered 34 countries, over two-thirds of respondents associated science with men and boys (Nosek et al., 2009), although with noted differences across global regions, which demonstrates the importance of intersectionality. Gender stereotypes can be compounded by trait-based stereotypes, that people in STEM are socially awkward, unattractive, naturally intelligent geniuses (Cheryan et al., 2013; Ehrlinger et al., 2018). An integrative review found that 'social factors, such as stereotypes and self-representations about "belonging," are powerful contributors to observed gender differences in STEM interest and academic outcomes' (Master & Meltzoff, 2020, p. 152).

Alongside notions that STEM subjects are for naturally gifted brilliant geniuses, there is a conception that STEM, and mathematics in particular, is hard and not many people can do it. This links with stereotypes about the mathematical, logical and abstract ways of thinking that are foundational to STEM subjects. There is an expectation of struggle, the challenge being a rite of passage or initiation. The struggle is seen as an opportunity to prove resilience, a belief often perpetuated by those who have 'succeeded' in STEM fields. This belief can lead to those who do not achieve success blaming themselves and concluding 'I'm not a STEM person'.

For academic staff, stereotypes about STEM fields continue: there are inequalities in accessing jobs, obtaining grants and gaining promotion, across gender and ethnicity characteristics, as well as other factors.

Concentration of research funding and recognition supports a ‘winner takes all’ culture. Research-based reward schemes within academia lead to a devaluing of teaching and student support. Professionalising, defining and recognising teaching roles, and a wider conception of awards, which signal what is valued, can broaden notions of excellence. Similarly, rethinking teaching beyond producing the next generation of STEM academics can be more inclusive of the whole student population. Repositioning the ‘struggle’ of STEM fields as one of ‘supported challenge’ can help more students stay in STEM subjects and develop the confidence to continue. The following case study explores a unique approach to offering ‘supported challenge’ in the chemistry curriculum.

Case study: the Chemical Kitchen

The Chemical Kitchen was created by Roger Kneebone and Alan Spivey (Imperial College London) and renowned chef Jozef Youssef (Kitchen Theory), with experiments designed and run by Jakub Radzikowski and Luke Delmas (Imperial). The project started in 2019 as an Imperial College London Pedagogy Transformation Project, part of their Learning and Teaching Strategy, curriculum review and innovation process.

The ‘skills gap’ between school and university is widely acknowledged as a challenge (Smith, 2012). New undergraduate students often come ill-prepared for laboratory work, even if their school grades are outstanding. Many are fearful of displaying ignorance of subject knowledge or of disclosing inexperience of practical procedures, especially, but not only, those from widening-participation academic backgrounds.

By combining expertise from high-end kitchens and laboratory science, the Chemical Kitchen encourages chemistry undergraduates to focus on practical skills without their usual preoccupation with scientific facts. Students are introduced to the mindset and some fundamental skills needed in a laboratory through the less threatening parallel of cooking and work on the level and unfamiliar ‘playing field’ of the kitchen. The project aims to free up attentional capacity (Seery et al., 2019), which helps them to develop as craftspeople (Kneebone et al., 2018) in the laboratory.

The Chemical Kitchen is a face-to-face programme comprising three three-hour sessions in classes of 15 working in groups of three. The programme works at three levels: gaining basic practical skills (e.g., weighing, heating and mixing liquids and powders); acquiring

more sophisticated skills (e.g., experimental design, collaborative team working, observation and note taking); and the essentials of 'scientific thinking' (e.g., exploration, creativity, critical thinking and innovation). Such activities empower tutors to communicate complex ideas in a simplified (but not simplistic) and challenging (but not threatening) manner, and students benefit from the changed perspective and reduced cognitive load. Students are able to reflect on practical work in their field and focus on the often omitted non-disciplinary aspects of their practice.

Evaluation reveals that students appreciate the fun and freedom of a challenge on an unfamiliar but level playing field, as illustrated by student feedback:

Chemical Kitchen was a really fun and inventive way to help develop my confidence outside of a lab. As a first year it can be quite daunting stepping into a lab for the first time, but this preliminary step allowed me to try some lab techniques and work with peers in a creative environment as well as making some really tasty foods!

The techniques used in the Chemical Kitchen practical such as suction filtration drew many parallels to those required in a normal synthesis. The 'kitchen' provided a much more relaxed and enjoyable method of learning these techniques, making our first real synthesis experiment less daunting.

(Radzikowski et al., 2021, p.712)

The lessons learnt from the Chemical Kitchen informed the institutional response to the Covid-19 pandemic, particularly with respect to how a 'lab in a box' approach was used to send simplified but fundamental experiments that could be performed 'at home' to a distributed population of students (MacKay, 2022). The Chemical Kitchen informed institutional approaches to experimental, discovery-based learning more widely. This approach has led to the inception of bespoke 'laboratory kitchen' spaces and an extension of the concept to other experimental disciplines (Radzikowski et al., 2021).

Challenging stereotypes in STEM – those placed on students and those students have of their environment – is key to offering an inclusive environment. The Chemical Kitchen case study is a great example of giving students a safe space in which to develop their STEM identity, which offers a level playing field for students coming with a variety of previous experiences. This approach advances all students, and moves

away from remedial education approaches targeted at disadvantaged students. The case study shows an inclusive approach, but one based on offering a high-quality education to all students rather than on attempting to mitigate a perceived deficit for a problematised minority.

Quality and excellence

Similarly to diversity and inclusion, quality and excellence are defined and measured by those with power. Excellence is a 'mark of distinction, describing something that is exceptional, meritocratic, outstanding and exceeding normal expectations. ... If some provision is recognised as excellent, it implies that the majority of other providers are simply satisfying standards' (Brusoni et al., 2014, p. 20). Harvey and Green (1993) offer three notions of quality: a traditional notion of quality, linked with distinctiveness or something special; the view that quality means exceeding high standards, which is linked with an elitist notion that this is scarce; and quality as meaning checking standards, based on baseline thresholds to be met. Although excellence is assumed as a core value in higher education (Rostan & Vaira, 2011), it is also a contested, situated and dynamic concept (Gunn, 2018; Gunn & Fisk, 2013).

Higher education in the UK is highly stratified. There are persistent social class inequalities in access to elite institutions (Boliver, 2011) and research has shown that attendance at the most selective institutions is linked with entry to elite positions in the labour market (Wakeling & Savage, 2015). There is little movement in the hierarchy of institutions (Croxford & Raffe, 2015), and notions of excellence are reinforced through rankings and league tables (Hazelkorn, 2015). These rankings fuel global competition across and within institutions (Brankovic et al., 2018), even as their empirical basis is critiqued and debated.

Furthermore, in his article about seminal myths in higher education, Macfarlane (2020) concludes that they cannot be substantiated by empirical evidence. He tackles a dominant narrative of the perceived tension between excellence and inclusion, namely, that admitting a wider range of students necessarily means a lowering of standards. The 'moral panic' described by Macfarlane in reaction to such myths homes in on debates about quality in higher education, and what makes an institution 'excellent' (O'Connor & Barnard, 2021). Work to widen participation has been slowed by a hesitation to move away from the status quo in an effort to preserve standards and 'retain' excellence. Now, more than ever, higher education institutions need to be critical of

discourses about inclusion, as these are used to examine, evaluate and predict student behaviour and the generalisations and stereotypes that are subscribed to by students.

Academic inclusion is a term used to specify how equitable access to skills and knowledge is. It functions as an evolving response to on-going societal problems, going beyond narrow demographic conceptions. Academic inclusion involves changing the nature of STEM disciplines: how roles are viewed, how contributions are valued and what success looks like. Culture plays a key part in how institutions put access and widening-participation policies into practice (Greenbank, 2007). What it means to be a student in higher education is changing, and at the same time students' expectations of their educational institutions are evolving beyond access to knowledge to include access to a community where they can belong, contribute and thrive (Maunder, 2018). Addressing the 'wicked problem' of how to diversify elite higher education requires new approaches and perspectives beyond the existing literature on higher education.

Looking outside higher education offers unique insights and recommendations to help higher education institutions capitalise on the potential of inclusive excellence. The study described below set out to explore inclusive excellence in other sectors in order to understand better what institutions outside of higher education are doing to widen participation and improve equality, diversity and inclusion (EDI), thereby providing a reflection on what the higher education sector can learn from others.

Case study: lessons from beyond, redefining inclusive excellence

Alejandro Luy, Imperial College London

How higher education institutions remain of high quality and diversify in a competitive post-pandemic future requires serious consideration as student, staff and regulatory definitions of what is excellent continue to evolve in the changing higher education landscape. This section reports on a case study that ventured beyond the higher education setting into other sectors with a similar focus on selectivity, competition and excellence, in search of insight and strategies for achieving inclusive excellence. Senior leaders from five sectors outside of higher education shared their reflections on diversifying their organisations while maintaining high performance, loyalty and well-being. Belonging

emerged as key to building an inclusive and effective community by unlocking diversity. Exercised diversity, empowered to align with the mission of the community, was found to be the core mechanism through which excellence was achieved across the sectors studied.

Leaders from organisations outside of higher education in which belonging or inclusive excellence was a priority were interviewed on how they promote inclusion, and maintain excellence and a strong sense of identity, within their organisations. The semi-structured interviews were thematically analysed and, although the themes that emerged across the various sectors investigated were strong and well evidenced, the results must be interpreted in the light of the limited sample of participants explored across a wide range of sectors. The participants' positions and sectors were:

1. Senior leader in a religious organisation
2. HR executive in a large mining company
3. High-ranking officer/academic in the British Army
4. Senior leader in the Scout Association
5. Retired Team GB (Britain's Olympic team) coach
6. Recruiter for a UK Premier League football team
7. Staff leader in Team GB
8. People executive for a leading online vocational education provider

Inclusion and belonging: the bedrock of inclusive excellence

A phenomenon observed across all the sectors investigated was that, in every context, creating an environment in which those recruited would feel 'valued', 'accepted', 'cared for', 'known' and 'listened to' was described as the key to unlocking the power of diversity while maintaining excellence and remaining competitive. Such phrases are all strongly related to belonging. Some leaders went as far as saying that belonging was one of the most important factors determining success. Participants reflected on the importance of recognising and empowering individuality, and said that labels and categories used to address EDI issues can sometimes be a barrier to enabling diversity to manifest (cf. [Read et al., 2003](#); [Yorke, 2000](#)).

The interviews suggest that belonging is the missing piece in the puzzle of inclusion, one that can help higher education institutions go beyond positive-discrimination measures and labels to enable individuals to exercise all dimensions of their diversity. If true belonging is the ideal state of a community and leads to enhanced performance,

loyalty, well-being and exercised diversity, which the literature supports (Brooman & Darwent, 2014; Furrer & Skinner, 2003; Kuh et al., 2010; Osterman, 2000; Pittman & Richmond, 2008; Thomas, 2012), then the definition and understanding of what makes a community excellent must evolve to include it.

Three dimensions of inclusive excellence that emerge from belonging were identified by participants. The first was a clear mission and purpose with which all activities, recruitment, culture and objectives should align. Although most communities can identify their primary goal and purpose, care is needed to prevent them leading to unidimensional success criteria or forcing individuals to fit into a one-dimensional success identity. Thus, the second dimension was that inclusive excellence must be authentically multidimensional. In many cases participants suggested that softer aspects of their community, such as culture and belonging, had previously been underrecognised despite being integral to success and excellence, and that they are increasingly becoming the prime area of focus.

The third dimension of inclusive excellence was an emphasis on collective success. In all cases, the mission and purpose were greater than what could ever be achieved by an individual, with the individual's goals oriented towards the shared objective. The alignment between person and purpose is driven by, and drives, belonging. This summary of inclusive excellence was described by Participant D thus: 'What I do connects to what we do.'

Lessons

The three dimensions of inclusive excellence found in this research, together with the finding that a strong sense of belonging among the members of the community should be the bedrock upon which inclusive excellence is built, and the external setting within which these results were found, provide a helpful lens through which to reflect on higher education institutions. With a sense of belonging, competition and excellence can be framed as being positive and inclusive rather than as driving an 'us versus them' approach and limiting inclusion. Leaders adopted language that both reflects and shapes feelings of belonging, empowering members to exercise their uniqueness while ensuring that any competition was positioned to achieve common, collaborative goals. The rhetoric was not about 'protecting' excellence from diversity but rather about realising, reframing, enhancing and pursuing excellence through diversity.

Curriculum and culture change

Exploring an institution-wide, holistic approach that has embedding diversity and inclusion at its heart can offer insight into how to counter the ‘more means less’ myth Macfarlane (2020) identified. This research explores staff members’ perception of their ability and of their sense of empowerment towards change, their perception of the prestige of research and teaching activities, and the impact of new teaching-based job roles. In the case study findings here, the focus is on aspects of equity, diversity and inclusion and how these are addressed in relation to institutional change.

Case study: inclusive curricula through new teaching roles

This case study reports on a research project that explores culture and curriculum change as part of a wider research and evaluation exercise of strategic reform at a UK-based research-intensive institution. The project utilises concept map-mediated semi-structured interviews to capture multiple data outputs through interviews with more than 50 members of staff over four years. As part of the wider project, interview data is analysed alongside the programme-level approach to the change process, drawing on discourse analysis of documentation of the process as well as programme-level and institutional-level evaluation indicators. This analysis of institutional change investigates an attempt to put inclusive excellence into practice. The approach draws on research on the prestige economy, which describes the beliefs, values and behaviours that characterise and express what a group of people prizes highly (English, 2005) and draws out ‘pedagogical currency’ metrics to support reward and recognition for high-quality educational work (Coate & Kandiko Howson, 2016).

Integrate identity and belonging to support inclusive excellence

A focus on active learning and interactive pedagogies in the curriculum review process has impacted staff and students. Students face new identities and new responsibilities for managing their educational experience. They become active agents in their education, not passive recipients of information. Innovative pedagogies integrating teaching and research have changed how staff holistically consider their academic role. Staff on teaching-only or teaching-intensive contracts have been developing credibility within their roles. Institutional support and

development have professionalised teaching, and formal academic qualifications are now available. Prestige for educational expertise is being developed, with experts identified throughout the institution (Kandiko Howson & Kingsbury, 2023). 'I'm sorry, but excellent researchers don't necessarily make excellent teachers. I'll leave it at that, on that particular aspect of it. But so [the institution] is valuing teaching much more' (Thierry). There are emerging social identities of staff who are focused on STEM-based teaching: those with advanced qualifications and research experience who concentrate on teaching and have dual, but often not equal, discipline and pedagogical expertise. Such staff bring insights of inclusive education into their disciplinary contexts and 'translate' diversity to make it relevant for their departments.

There's been a lot of focus on, and I feel that on the ground as well, like appreciating the diversity quite meaningfully and appreciating that [the institution] is, you know, a challenging place to be. You get quality, world-class education, but that also that different people approach it differently and by people, I mean students. (Shahrazad)

Laying the foundations through new staff roles has been a key part of the institutional journey towards inclusive excellence. However, changing the profile of staff and students is a long game. 'You know that we don't have a diversity problem. We have a huge diversity problem' (Noel). While demographic change takes time, staff on the ground reflected more on making the educational experience on offer more inclusive and more relevant to the student body, now and in the future.

Curriculum as the core delivery method

At its core, the main ethos of [the institution] is excellence in learning and education. But it's really thinking about how can we deliver this for the next 10 years, the next cohort of students who have very different needs, very different demands, and also appreciating that the more global we get, the more difficult it will be to accommodate or appreciate this diversity within our student body, but also celebrate it. So it's not just about accommodating them but also celebrating, because I think there's an appreciation that this is the strength – that within that strategy that diversity is capitalised on the strength of that diversity. (Suki)

There was a strong sense among interviewees that successful inclusion required integration within the curriculum, not just activities or clubs outside of the academic experience. 'I think one of the best ways to measure [excellence] is the alignment between what's being delivered and what's being ... adopted by the students. So it's the application of what they've learned, and that's from the educational or the excellence in scientific research and rigour' (Stef). In this way excellence is defined in the quality of teaching. For some staff, inclusion is seen holistically, rather than by splitting out different indices of diversity.

And then I help plan the programmes with the leads and the administrators. And so working with the curriculum to see if we've got repetition, or if we're actually at the cutting edge, one is doing what it says on the tin or if it's cutting edge from a few years ago, making sure they're student-friendly, making sure they're inclusive, so that, as many people, say students with disabilities, or students coming from a different culture, are included and that they're able to access programmes properly. (Teo)

Equity, diversity and inclusion as incidental

For many staff, diversity did not feature in their discussions about curriculum change. This absence was echoed in documentary research, which featured little explicit mention of inclusion. However, a lot of changes were put in place that would support diverse learners. 'It is an EDI thing in that it is to do [with EDI] ... not that it is what it was brought in for ... it may not have been anybody saying "Ah, we need to do this for equality and inclusion reasons"' (Axel). Many staff mentioned wanting to support their students from different backgrounds, but they did not necessarily see this as supporting an inclusive environment. 'I haven't really implemented anything there. I think it's probably more that we try and be aware when we make, say, seminar groups, tutorial groups' (Narinder).

Many interviewees felt that there was little they could do to bring diversity into the curriculum content given the STEM nature of their disciplines. 'I'm not aware of anything particularly explicitly that I did. I tried, so one of the things that I do is talk about historical figures in the field as the various kind of relevant laws and things come up. They are almost universally white European, and there wasn't a lot I could do about it' (Harshit).

There is debate about whether making the education experience more supportive for the students at hand is true 'inclusion'. For many STEM staff, the goal was a curriculum that all students could access and

succeed within. This signals a focus on academic inclusion, with notions of students' belonging being based on an understanding and a connection with the discipline and a logical, mathematical way of thinking, over socio-demographic definitions of diversity.

We recognise that actually one of the big bits of feedback was that students are coming in from, so this is an EDI thing I guess, people from lots of different backgrounds with lots of different initial skills, and actually finding what the correct level was, without being assessed, was quite important. (Abady)

What emerged from this case study was a sense that diversity was supported at a high level within the institution, but that developing an inclusive environment stemmed from local activity and was delivered in the disciplinary context. The emerging STEM teaching-focused staff with dual discipline and pedagogical expertise were more explicitly aware that diversity in their active, discovery-based contexts enriched the learning experience for all, and were more likely to purposely position diversity in that context, rather than seeing it as a problem to be solved or managed. In one way this approach is more authentic and bottom-up, but it can be piecemeal and left to individual initiative.

Conclusion

This chapter highlights perceptions of the role of prestige in relation to research and teaching, the sense of empowerment towards change, and attitudes towards diversity and inclusion and the impact on staff's own academic identities. While the notion of 'inclusive excellence' can seem straightforward in theory, in practice it is a much trickier concept. It is challenging to apply inclusive practices to specific institutional and disciplinary contexts. Furthermore, how inclusion manifests in relation to the curriculum will be different in STEM than in the social sciences and humanities.

The examples from sectors beyond higher education shows the integral relationship between inclusion and belonging and how excellence can be achieved through wider and more expansive notions of belonging rather than through exclusion and 'othering', as noted by Hyland in [Chapter 2](#) of this volume. The case study of the Chemical Kitchen showed how embedding activities into the disciplinary curriculum can help students to transition into new identities and to develop skills that help

them to feel comfortable in their new environments. In many STEM subjects, it is in the delivery of the curriculum, rather than its content, that inclusion is operationalised. Thus, we see belonging as an affective outcome of staff and student experiences, not something that is forced or imposed. Similar examples from contexts beyond higher education were offered, which showed that belonging is situational and relational (Gravett & Ajjawi, 2022).

True inclusive excellence in STEM higher education is not about competing to be the best in a narrow field, but about broadening notions of success and working collaboratively with others. Inclusive excellence is about more than widening participation; going beyond issues of outreach and access we must transcend the fear that diversifying intake leads to perceived or actual erosion of standards and outcomes. The competitive nature of STEM fields, exacerbated in selective institutions, requires the reconceptualisation of success to incorporate wider indices, which embed inclusion as an essential aspect of excellence. Inclusive excellence entails reframing competition as collaborative and about striving to be the best that you can be rather than better than others, reframing difference as enriching the learning experience for all, and being pedagogically positive rather than seeing diversity as a problem to be solved. Cultural reframing is complex, and the case studies suggest that it requires top-down support and recognition and bottom-up embedded, integrated acceptance within disciplinary contexts to achieve lasting change.

As mentioned by interviewees in the research, inclusion is forward-looking, and entails developing STEM fields to have the capacity to deal with tomorrow's problems while not being confined by yesterday's standards.

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