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Meghna Nag Chowdhuri & Louise Archer

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Getting comfortable with discomfort: supporting primary science teacher educators' capacity for socially just pedagogy

Meghna Nag Chowdhuri and Louise Archer

IOE, UCL's Faculty of Education and Society, London

ABSTRACT

Despite longstanding calls for social justice-oriented teaching, there remains limited understanding of how to achieve it. This paper reports findings from a research-development project that explored the experiences of UK-based primary science teacher educators participating in a nine-month equity-oriented professional development programme and offers insights for supporting teacher learning for social justice. Analysis of written reflections and open-ended interviews with 15 teacher educators identified three types of reflection that supported justice-oriented practice: personal privilege in relation to race, class, gender and science; the norms and values of educational professional development; and practical implementation of justice-orientated professional development with teachers and schools. We discuss the importance of creating safe and brave spaces for critical reflection for primary science teacher educators and highlight the productive potential of experiences of discomfort that generated humility, empathy and insights that resulted in more equitable practice. The paper underlines the value of supporting educators to embrace discomfort as part of social justice-orientated professional development and calls for a greater valuing of and support for expanded models of professional development that foreground critical reflection and go beyond 'top tips', 'quick fixes', and dominant norms around professional 'politeness'.

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Teacher learning for social justice in science education

Longstanding calls for justice-orientated teaching remain as urgent as ever especially as social inequalities continue to grow within many educational systems. Since Freire's (1970) foundational work on critical pedagogy, the principles of teaching for social justice have been expanded through the valuable contributions of scholars such as Ladson-Billings (1995) on culturally relevant pedagogies. These works have led to a considerable body of literature exploring teacher education for social justice in general (e.g. Goodwin and Darity 2019; Hambacher and Ginn 2021; Kaur 2012; Parkhouse, Lu, and Massaro 2019; Pugach, Gomez-Najarro, and Matewos 2019; Reagan and Hambacher 2021) and in relation to specific subject areas, such as science

CONTACT Meghna Nag Chowdhuri  m.chowdhuri@ucl.ac.uk

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(e.g. Atwater, Russell, and Butler 2014; Bancroft and Nyirenda 2020; Maulucci 2012). This work has highlighted four main issues: the centrality of critical professional reflection; teachers' resistance to teaching for social justice; the importance of 'brave' and safe spaces for professional development (PD); and the particular challenges facing science teacher education for social justice.

The centrality of critical professional reflection

Critical reflective practice involves questioning one's own assumptions and engaging with issues of power (Thompson and Pascal 2012) through 'the conscious consideration of the moral and ethical implications and consequences of classroom practices on students' (Larrivee 2000, 294) in order to understand and challenge social injustices. It has been referred to as the 'highest level' of teacher reflective practice (Larrivee 2000) and lies at the core of equitable and justice-oriented pedagogical approaches (e.g. (Arday 2019). Yet very little time, if any, is given to supporting critical reflective practice within many teacher education programmes (e.g. Ellis, Souto-Manning, and Turvey 2019; Kohli 2019). While there are various different approaches to critical reflective practice, Archer et al (2022) identify three key common features: developing knowledge/understanding of social justice and equity issues; critical self-analysis of one's own positionality, values and behaviours and; critical reflection for action and intentional practice.

Teacher resistance to social justice professional development

Teaching teachers about social justice remains a neglected issue within mainstream teacher education. For example, a review of teacher education initiatives by Goodwin and Darity (2019) found this to be the focus of just 4% of articles. Yet evidence shows that resistance, tensions and difficulties often characterise teacher education around social justice (Archer et al. 2022; Parkhouse, Lu, and Massaro 2019; Reagan and Hambacher 2021). Sleeter (2000) suggests that while most existing work usefully documents how student-teachers resist social justice approaches, the literature does not provide 'strategies for how they can actually become more socially just teachers' (p. 227). This continues to be the case as more recent reviews make similar observations (Grant and Agosto 2008; Parkhouse, Lu, and Massaro 2019).

Transformative professional development: safe and/or brave spaces

Bondy et al. (2017) offer a 'justice as praxis' framework which identifies the characteristics of a productive space for social justice learning as being one of radical openness, humility and self-vigilance. Radical openness requires student-teachers to be 'open' about their learning, including being 'confused' and acknowledge 'not knowing'. Self-vigilance additionally equips teachers to be self-aware, and also aware of their surroundings and their social positioning of privilege within the field.

Arao and Clemens (2013), similarly argue for creating 'brave spaces' rather than merely 'safe spaces' to support learning about social justice, in which participants commit to 'agree to disagree, don't take things personally, challenge by choice, respect, and no attacks' (p. 143). In this way, participants respectfully challenge one another, going

beyond what Sue (2016) calls the ‘politeness protocol’ (p. 57), which constrains productive dialogue around race and other forms of social difference and injustice.

Primary science teacher education for social justice

Most of the existing literature discussed comes from North America and UK-focused studies remain relatively rare (Bhopal and Rhamie 2014; Davies 2021; Kaur 2012). The small number of existing UK-focused studies focus predominantly on initial teacher education (ITE) context (Bhopal and Rhamie 2014; Davies 2021; Lander 2014) and highlight how teacher educators are not prepared for teaching about justice (in particular race). For example, Davies (2021) finds ‘race dysconscious’ practice (p. 9), wherein issues of racism is missed out completely from ITE programmes. They also draw attention to how racial injustice is often addressed through externally contracted ‘experts’ rather than through in-house ITE expertise. Thus, issues of race and privilege remain marginalised and teacher educators end up feeling unprepared to address such issues in their teaching (Bhopal and Rhamie 2014). Within science education, teacher educators find it particularly difficult to provide social justice-related professional development and training as science continues to be viewed as a culture-free subject with focus on content knowledge (Crabtree and Stephan 2022; Patterson and Gray 2019).

Our paper aims to contribute to the literature empirically and conceptually by focusing on the under-researched context of primary science teacher educator PD in the UK. It explores primary science teacher educators’ reflections during a PD course designed to build understanding and capacity for social justice-oriented science teaching among UK science teachers. Specifically, we ask:

- What supported primary science teacher educators’ understanding, engagement and uptake of social justice-oriented science teaching?

Research context and sample

The paper analyses data from a 9-month professional development course provided by three university-based researchers ([names]) working with 15 primary science teacher educators based in the UK. The course was designed to support participants’ understanding of a social justice-oriented teaching approach (Primary Science Capital Teaching Approach – PSCTA) (Nag Chowdhuri, King, and Archer 2021). Participants were all volunteers who had chosen to attend the course to increase their understanding of social justice issues in primary science education and gain accreditation to train teachers in this approach after the completion of the course. The online course was offered to trainers already working in some capacity with the project funders (as fellows or regional representatives), and their costs of attendance were covered by the project funders. While the researchers had been working closely with the funders (professional development trusts) had not previously worked with the participants. All participated consented to be part of the study, and their information has been anonymised for this paper.

The course included eight online-workshops, each lasting 3 hours, which were designed to introduce participants to the various elements of the teaching approach and were facilitated by three university-based researchers. The workshop content was based on the PSCTA teacher handbook which includes a reflective framework for teaching

science for equity. However, each workshop was iteratively designed informed by the written reflections and in-workshop responses from the participants. The sessions included case studies of realistic teaching and learning scenarios in primary schools, meant to provoke reflections and support participants to visualise and discuss critical equity issues. In addition to attending these workshops, participants were also required to deliver training two class teachers from two different schools to 'try out', apply and refine their learning. After each workshop, participants were asked to produce written reflections in response to a given reflective question. Participants also created portfolios to document their learnings, collate their reflections and detail evidence of the impact of their training for the teachers they worked with. The purpose of the portfolio was two-fold: first, to understand what kind of training activities were conducted by the participants and second, in what ways were they able to critically reflect on their training approach. Workshop sessions were designed to support participants to understand and engage in critical reflection. Participants were provided reading lists to deepen their understanding. Finally, monthly 'check ins' were offered as a form of informal one-to-one support.

Developing and sustaining the PD course as a 'safe and brave space' required re-negotiation with participants of dominant professional norms that usually expect demonstrations of expertise, rather than vulnerability. The course began with an explanation by facilitators that the programme was based around critical professional reflection and did not involve providing participants with any 'script' or 'training' in the application of tools or resources. This came as a surprise to some participants and prompted some discussion. The course was intentionally designed (in its structure, activities, and resources) to support participants to engage with the issue of discomfort and to understand and explore how discomfort can be not only productive but also a key part of critical reflection. This theme was worked through the course materials (e.g. the PSCTA handbook), the content and focus of delivered sessions, additional readings on the value and process of critical reflection for social justice-orientated pedagogy (e.g. Bailey 2015 on 'white talk'), course activities (e.g. reflective writing set as homework on the topic of 'difficult or uncomfortable moments in your practice') and scaffolding and 'culture-setting' elements of the course (e.g. establishing shared norms on how to share and engage with each other's narratives and experiences, withholding judgement, confidentiality of discussions, etc). The facilitators also engaged with participants outside of the sessions, as required – for instance, providing support and reassurance to a couple of participants who wanted to share outside the session a difficult experience of injustice.

Scaffolds used to guide teacher reflections included critical reflection exercises within sessions and via 'homeworks'. Teachers were also provided with support when piloting the approach with colleagues, through structured summary sheets and powerpoint decks (to support delivery), reflection sheets (to structure and record critical reflection) and regular drop-in clinics during the delivery period. The drop-in clinic was set up to enable sharing of feedback and concerns among the peers, in addition to one-to-one catch ups between participants and a nominated facilitator.

Two of the university-based researchers identified as white British women professors (R1/author 2, R2), the third identified as a South Asian woman post-doctoral researcher (R3/author 1). Of the 15 teacher educators, 11 identified as women and 4 as men, with 14

identifying as White and one as South Asian. All the 15 participants had more than 10 years of experience in science education in some capacity (teachers, scientists, teacher educators, curriculum development) and were all engaged in providing some form of PD within primary schools in UK. Finally, the participants worked in a diverse range of schools both in urban and rural settings serving students from a variety of socio-economic backgrounds.

Data comprised of total 58 participant written reflections submitted during the course and 15 open-ended semi-structured interviews conducted at the end of the course, each of which lasted between 50 and 75 minutes (conducted by author 1/R3).

Data from the written reflections and interviews were imported into NVIVO and were initially coded by the lead author using NVIVO using the tripartite lens developed by Archer et al (2022) as a framework. Hence data were coded in relation to factors which seemed to support or constrain participants' (i) understanding of social justice issues, (ii) their engagement with social justice pedagogy and (iii) their capacity to intentionally integrate these ideas into their practice. In addition to using the tripartite framework, the lead author also searched the data for any emergent codes that were not covered by the framework relating to the factors and strategies that participants identified as supporting them in this journey and the second author conducted a wave of analysis paying particular attention to the affective dimensions of the participants' experiences (Wetherell and Potter 1988). Since the researcher conducting the training course was also the one conducting interviews, analysis and writing up – it offered both advantages and disadvantages. The longer association with participants meant that the author was able to build a close relationship with the participants and witness different dimensions of their practices (as participants of the course, as trainers supporting other classroom teachers, their written work, their in-session contributions, and evidence they provided in their portfolios). These provided useful prompts during the semi-structured interviews, which enriched the discussions. On the other hand, there was an inherent power dynamic where the author/researcher was also 'accrediting' them, and thus there was a danger of performativity. Codes were then shared with and checked by both authors, resulting in some minor adjustments to the coding frame (e.g. combining categories that appeared closely related). The final coding frame was then applied to the wider data set, including evidence from portfolios, and in-training recording observations. This process of analysis was conducted first independently by the two authors and were then discussed and combined into a final set of themes, which resulted in the identification of three main forms of reflection among participants, as discussed next.

Findings

As discussed in turn next, our analysis identified three main forms of reflection that participants engaged in – the first two of which particularly supported their understanding and engagement and the third of which supported their implementation of social justice ideas into practice.

Reflections on personal privilege and positionality

As noted by the wider literature, participants recognised that reflection on privilege is 'rare' in most PD courses. Harpreet explained, she felt there were few if any opportunities to engage in social justice-orientated PD and this programme was 'the first' that she had come across. As Brian also explained, not only did participants feel that the focal topic was distinctive, but also engendered reflection on their personal privilege:

In fact, rarely was I ever made to feel like this in my academic/educational environment, either because my view[s] was/were not sufficiently different from those around me to warrant comment, or, as I am now realising, most likely because everyone in that room shared some level of privilege where the issues being discussed were not something I/they themselves had direct experience of. (Brian)

In line with existing research, we found that the participants engaged in varying levels of critical reflection, from 'surface level' to 'deeper' forms of reflection, often moving from the former to the latter over time. For instance, mid-way through the course, Ed worried what 'authority' he would have to train teachers or students in equity issues:

As a white, middle aged, middle class, educated, man I tick pretty much every privilege box going and I wonder how much authority that gives me when talking about issues of discrimination? I'm not sure I am in a position to be taken seriously if I am trying to advise people, colleagues or children, who are experiencing discrimination of any sort. (Ed)

This type of conundrum over what (or whether) one can 'do' or 'say' (as a privileged professional) has been interpreted by Archer et al. (2022), as 'surface consciousness' which exempts the privileged individual and can deflect them from responsibility for 'doing' anything.

However, over time, the participants began to engage in more critical and sustained reflection on their positionality and privilege. We interpreted some of these reflections as focusing on the *stadium* (Barthes 1981) of the experience, that is, the intellectual interest and new knowledge/understanding gained through critical reflection. For example, Anna expressed becoming much more aware of white privilege, similarly Sara felt encouraged to 'read more widely' on issues of whiteness and other injustices.

I'm much more aware of my white privilege than I was. I had heard of white supremacy, but I don't think I got it to the extent I do now. I am more aware of my own privilege, and I can only imagine for you [researcher 3] and Harpreet how it is. [...] (Anna)

However, we found that it was where participants experienced the *punctum* (Barthes 1981) of critical reflection – that is, the emotionally arresting and disruptive 'punch' – that led to productive shifts in their subjectivity and positionality. That is, rather than being a 'dry' intellectualised exercise with reflection, the 'punctum' of reflection was manifest through the emotional reactions such as shame, shock and embarrassment to the realisation of privilege. For instance, Olivia felt 'shock' and 'ashamed' by the realisation that her previous 'colour blind' stance might be reproducing inequalities:

This session made me reflect very deeply and made me feel a huge range of emotions especially about White Privilege and White Talk. When I saw the quote: '*I don't see colour – I see and treat everyone the same*'. I felt shocked and ashamed as I have said this before to a couple of close friends of colour whilst discussing incidents in which they have experienced racism. By saying this I intended to show solidarity (that I was an 'ally') and that I did not

condone such racist behaviour - but to discover from the workshop this was a clear example of White 'boomerang' talk horrified me! (Olivia)

While the white, middle-class professionals experienced the most 'punctum' from the reflections on privilege, as a racially minoritized woman, Harpreet also found the course 'useful' both intellectually but also in terms of the punctum of having her experiences of injustice recognised and validated:

'I think it's been useful for me as a person of colour . . . and not just as a person of colour but because I'm a female as well and there's lots of issues around equity'. (Harpreet)

In addition to reflecting on gender, class and racial privilege, the teacher educators also came to recognise their own science privilege. In particular, they seemed to develop a new appreciation of how, as experienced trainers with science specialist qualifications, they occupied privileged positions within the field of primary science (which meant their assumptions were often quite different to those of the teachers and children they worked with). For instance, Anna was a scientist before becoming a teacher educator and explained how previously she could not understand 'disinterest' among student-teachers for science:

I've done a fair bit of teacher training courses, and I'd always felt if they've decided to be on the teacher training course, and they know they've got to teach science they should want to learn. Because I was a scientist before [. . .] I didn't have a problem accessing it [science]. I feel a little embarrassed and uncomfortable because I think I've realised that maybe those teachers had bad experiences with science as kids, perhaps they really feel they can't do it. (Anna)

Several participants commented on how such realisations of professional privilege were a 'humbling' experience that made them question their previous practice. For example, Emily described how she came to see her previous practice as 'arrogant', assuming she already knew what there was to know about good science teaching, which did not include equity issues. Similarly, Amanda came to question dominant accolades and measures of 'good science teaching' that celebrate normative ideals of teaching that do not include social justice pedagogical principles:

I won the [Award] and became the [name] Fellow - I can teach a really good lesson [. . .] I've been an adviser for years, surely, I'm a really good teacher you would think. But it's been quite nice in a way to stop and think, okay so maybe it's not as simple as that. Am I really a good teacher? Because I've been thinking so much about the science, I hadn't actually realised that I wasn't really seeing them as pupils, I was teaching my science lesson to them, I wasn't really seeing it through *their* eyes. (Amanda)

These accounts resonate with Bondy's et al. (2017) idea of 'humility' as a productive way of doing social justice-related work, specifically the humility of accepting that there are things that are 'unknown' and learning about social justice-oriented teaching requires openness. Indeed, a number of participants frequently articulated their concerns that they did not fully understand what social justice pedagogy entails, describing themselves as 'still on this continuum of understanding' (Emily) and 'not sure I've really got it' (John). However, as exemplified by Amanda's example above, 'felt' forms of critical reflection on privilege helped lead participants towards more empathic, student-centred teaching that foregrounded issues of social justice. Furthermore, for some, as illustrated by Grace's

quote, critical reflection on privilege helped them to reconceptualise their professional goal as working towards becoming an ally for under-served communities and learners:

I've come from a lot of privilege ... So, I'm worried about being patronising. I'm worried about ... [being asked] 'well how do you know about it? 'You don't know what it's like to be from this this this particular group'. I think it's better to think about that and try and do something, than to sit back and say I can't do anything about it at all and throw my hands up in the air and say nothing. I think it's something that's quite empowering, you can't change what you are, but you can seek to advocate for other groups. (Grace)

Thus, rather than using her reflection on privilege to get herself 'off the hook' (Archer et al. 2022, 52) from having to challenge injustices, Grace works towards recognising the complexities of her positionality and becoming an active advocate or 'ally' for social justice. This echoes what Pollock et al (2010, 221) have identified as being the struggle at the heart of teacher education around social justice, moving from an 'either-or' framing (one can either be privileged and hence unqualified to engage with social justice issues or have lived experience of inequality and hence the authority to address social justice) to a 'both – and' position.

Reflection on the norms and values embedded in teacher professional development and teacher education community

As the existing literature discusses, resistance to critical reflection and social justice professional development is not uncommon among teachers and teacher educators (Reagan and Hambacher 2021). Accordingly, there were instances during the PD participants resisted what they felt to be negative comments or judgements on their practice or views that were offered by fellow participants. For instance:

I felt [participant name] was being not critical in a bad way, it was positive criticism but critiquing what had happened, but I think her experience is very different to what is happening over here [in schools I work in]. (Anna)

I felt a bit attacked in that session. Like passive aggressively by one of the participants' feedbacks and felt like I couldn't say what I thought. I thought the social justice part of it is the hardest for teachers to understand and I remember trying to think of a way to make that accessible for all teachers, but I felt that was attacked. (Julie)

Harpreet in particular recognised this issue as a dilemma inherent to attempting to engage in social justice work, that necessarily involves challenging privilege and dominant ideals around professionalism and 'being polite':

For me the issue is that we're in a professional setting. In a personal setting you can have a disagreement and then either you are friends or not friends. In the professional setting, we didn't choose who the group is, we have to remain polite, we have to be professional because we don't want to have an argument in a professional setting. (Harpreet)

Specifically, Harpreet confided on more than one occasion that she worried about saying things that might be interpreted as too 'controversial' (such as recounting her experiences of racial inequality in teacher education settings) which might have a negative impact on her professional relationships and career. As one of the few

women of colour working in this space, she worried about the impact of ‘toppling’ dominant ideas or ways of being:

You are the only one there and if you say anything to topple [the status quo], you’re going to be cut out as well and there’s nobody there. (Harpreet)

As Harpreet explained ‘there is a point where my professional role and my personal role clash, ... where they meet, and I am always trying to balance between. I don’t want to offend people’. These examples evoke what (Sue 2016, 24) calls the ‘politeness protocol’ which silences challenges to the status quo and requires that issues such as racial injustice that might be experienced as uncomfortable to dominant communities should either be avoided or spoken about only in superficial ways. However, over time, most of the participants came to experience the programme as a ‘safe space’ that supported critical reflection by welcoming respectful challenge:

People trusted each other so it was an open forum where you could ask a question, and people would answer it or disagree. But it wasn’t disagreed aggressively or offensively. (Jerry)

Critical reflection is uncomfortable, but it was handled sensitively. The session didn’t preach [...] I’ve enjoyed working as part of a team, hearing what others had to say. Made me get into the mindset of the approach quicker than perhaps I would have done. (John)

The safe nature of the space facilitated ‘braver’ forms of reflection as participants started to engage with the challenge of ‘being comfortable with discomfort’:

That was kind of a light bulb moment for me, and I have tried to make it clear to the teachers that you will feel uncomfortable, but it’s about becoming comfortable with feeling being uncomfortable. (Brian)

In this way, participants identified how the nature of the space (yet brave) was key to supporting their own critical examination of privilege that helped them in turn to develop new forms of social justice-orientated practice.

Reflection on implementation of social justice pedagogy with teachers and schools

The final productive form of reflection involved the teacher educators thinking about how they might implement ideas from the course into the professional development that they offered teachers and schools. This reflection helped them to think through responses to a range of potential forms of resistance that they might encounter when delivering social justice-oriented PD. For instance, Olivia and Emily felt that traditional (short) PD formats encouraged teachers to prefer training that provides ‘top tips’ (and particularly those that focus on supporting higher attainment), which sits at odds with the time and commitment required to engage in critical professional reflection for social justice pedagogy:

When I’m working with teachers, they usually want to be given tips and the latest resources [...] They’re looking for something like that from these sessions, and if you suddenly start delving into some of these really deep things and they’re not ready for it, I’m not sure how they would respond. (Olivia)

I believe that teachers still want to see the direct link between an approach and the impact on attainment – it therefore will take much more time to develop a deeper understanding of the bigger picture of social justice, engagement and inclusion in the classroom. (Emily)

Some worried that only schools serving diverse communities might see social justice as relevant form of PD. For instance, Jerry felt that the approach would be welcomed by the school he worked with but only because their student demographics were changing:

In the school that I work in, because we can see that our catchment is changing. It's becoming more diverse and less rich. So, some of the messages and lessons especially around minority disadvantages from this course, are really apt. (Jerry)

However, participants also engaged in reflection-for-action (Thompson and Pascal 2012) to identify ways of addressing these challenges. For example, Julie worked in a predominantly white rural school with a small number of Black or Traveller community children and came to re-frame social justice issues as particularly important for schools like hers where there was likely to be a higher likelihood of 'unintentional ignorance' and exclusion:

The single black child or traveller in my class, whilst not deliberately excluded was not purposefully included. ... This has made me very aware of how much more important inclusivity is in regions such as mine which are predominantly white, and schools like the ones I've worked in where staff are predominantly white women – both for those children who feel excluded and alone but also for the majority who grow up unintentionally ignorant. (Julie)

Rachael also developed a notion of diversity and exclusion that went beyond common 'visual' demographics:

Although all our children look the same and come from families that would be traditionally Christian families, they actually have very different life experiences. Our issue is rural poverty ... I think that's a type of equity issue that is worth exploring. (Rachael)

Through such forms of reflection, the teacher educators started to explore the complex nature of systemic disadvantage, moving towards a more intersectional understanding of power and privilege (Pugach, Gomez-Najarro, and Matewos 2019). Additionally, participants started to consider how they might challenge and rework dominant expectations of professional development, moving towards models that take longer and prioritise time for listening and reflection. For instance:

I'm beginning to think that this [PD] is almost a three-year cycle. So, you've got a year for training and working with a pilot school. A second year to roll it out across the school. The third year for them all to actually do it. Then you need to go back again, after, I think you might need to go back after three years and say, we've done this, to almost redo the initial training again. (John)

Although, as Sara explained, the teachers she worked with had 'genuinely really enjoyed' this reflective approach, as Emma and Olivia also recognised, this would need 'selling' and 'packaging' to make the offer attractive to teachers and senior leaders:

I think the teachers genuinely really enjoyed the opportunity to think in a way that perhaps they don't have time to think in their daily jobs. (Sara)

For me [the challenge], it's actually, considering how to package the approach, while making sure that there is all that additional time for reflection. (Emma)

It's a long-term journey for some of these schools and you need to get that buy in from the senior leaders to make sure that that is going to work. So, it's a much bigger thing than saying, 'Well this is a quick fix'. Because it isn't. (Olivia)

As part of securing this 'buy in', participants identified a range of further ways that they might engage teachers with social justice-orientated professional development, such as through translating terminology, using practice-based examples and scenarios in their materials that teachers could relate to, and grounding sessions in participants' lived experiences:

... there are a lot of social science-y kind of words, such as equity, transforming power relations, etc, that doesn't mean a great deal to your average teacher or your average layperson like myself but looking at examples helps the penny drop. (Anna)

I think teachers learn very much from having examples given to them so that it's not necessarily theories that will make them catch on. (Olivia)

Having those discussions [about examples] then leads to big discussion about what are we doing in our classrooms? Are we always thinking things through? (Charlotte)

Discussion

There is arguably an urgent need for social justice-orientated PD in the UK – especially as such issues are usually only touched on lightly within ITE despite evidence of widening social inequalities. Our paper has sought to contribute to the important yet under-researched topic of PD for social justice in UK primary science education. Drawing on interviews and written reflections conducted with 15 teacher educators who participated in a social justice-orientated professional development programme, our findings suggest, that PD delivered through extended safe and brave spaces, that support critical reflection on personal privilege (both social and science-related) can enable primary science teacher educators to move towards more socially just understandings and practices.

We suggest that these findings contribute to and extend existing literature in the following ways. First, our study found that critical reflection was centrally important for primary science teacher educators to understand and enact a social justice orientated pedagogy and professional development, both in relation to their own race/class/gender positionality but also their science privilege. While there were some instances of resistance, particularly towards the start of the course, most participants engaged in productive critical reflection. Most impactfully, embracing the 'punctum' of recognising privilege resulted in greater humility, empathy, student-centred practice and a shift to seeing oneself as a social justice 'ally'.

Second, the creation of a safe and brave spaces for PD was key to facilitating participants' capacity to engage in critical reflection and to support their collective reflection of intentional action. The creation of safe and brave spaces enabled most participants to sit with discomfort and achieve personal critical reflection.

Finally, while most embraced the opportunity to investigate their practices through a social justice lens, a number of educators worried that the capacity for them to support

teachers towards socially just pedagogy would be curtailed by the dominant ethos in UK teacher PD that prioritises top tips, quick fixes (Ellis, Souto-Manning, and Turvey 2019) and the 'politeness protocol' (Sue 2016), over sustained critical reflection on equity issues. However, educators identified ways forward to support implementation through PD including: a more complex understanding of inclusion and difference in classrooms; asserting the value of translation of ideas into examples and using scenarios.

We suggest that our findings have two main implications for primary science initial teacher education and professional development policy and practice. First, we suggest that there is currently a dearth of support for primary teachers to understand and engage with issues of inclusion and social justice and develop more equitable pedagogy. We call for value and space to be given to such issues within initial teacher education. Such issues could usefully be covered both in relation to teaching in general but also explored in relation to how they might be addressed within specific subject areas, such as science at both primary and secondary phases. Second, PD aimed at supporting social justice-orientated pedagogy within UK primary science needs to foreground the importance of supporting teachers and teacher educators to embrace discomfort within professional development programmes. That is, such programmes need to strive to be brave spaces (Arao and Clemens 2013) in which teachers and educators are supported to engage with both the *studium* and *punctum* of the course content as experienced through critical reflection on personal and professional forms of privilege, with particular emphasis on the *punctum* that comes from the disruption of privilege as signalled through 'difficult' felt emotions that can lead to productive changes in understanding and practice. Careful consideration and planning will be needed in this respect to mitigate dominant professional norms that discourage discomfort and disruption. We additionally suggest that attempts at supporting discomfort might usefully consider how to ensure that spaces are (i) safe for the recognition, sharing and expression of the discomfort and pain that come from experiences of oppression and injustice and (ii) brave for the experiences of discomfort and 'shame' that come from the disruption and challenging of privilege. In these ways, discomfort can be used as a tool to help educators and teachers to reflect on and for practice in more socially just ways. Additionally, we suggest that primary science teacher educators should be supported to critically reflect on injustices within science and the challenges posed by professional science educator identities that are often grounded in dominant ways of knowing and being.

Finally, we call for a greater national valuing of and support for expanded models of professional development. Transformative professional development, such as in the case of social justice-orientated approaches that prioritise critical professional reflection, needs time, resource and space to enact. Yet in the UK, teachers find themselves ever increasingly time and resource poor against a context of intensifying social inequalities. If teaching is to help challenge social inequalities in meaningful ways, then it will require support and investment in transformative forms of professional development.

Considerations

While our findings suggest that there are various ways in which primary school teachers might be usefully supported in their understanding of social justice, there are, of course, various caveats to our study. For instance, findings are primarily based on self-reported

data from participants, which, as the literature discusses, can be unreliable (e.g. Herrington, Yerzierski, and Bancroft 2016; Koziol and Burns 1986).

Additionally, all participants were self-selecting volunteers who were attending the course in order to gain accreditation and thus may have been motivated to please the facilitators and respond as they felt was wanted. Thus, we recognise that there is a possibility that trainers were ‘talking the talk’ (e.g. in relation to their expressed views on practice) while evidence of whether they also ‘walked the walk’ (i.e. enacted these aspects in their actual practice) was not collected (Bhopal 2023). The dual role of the researchers as course facilitators and assessors (for the accreditation) also constitutes another potential influencing factor that may have biased participants’ engagement and the findings/analyses.

Our paper aims to identify markers of shifts and the complexity of the process of embedding social justice into practice within science teacher education landscape. Additional data on how these trainers go on to train other teachers, as well as impact classroom teaching and learner outcomes, would further help provide a more triangulated and richer picture of potential change.

Disclosure statement

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