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Abstract

This paper discusses an attempt at a Bourdieusian-inspired form of praxis, developed and implemented in collaboration with nine London teachers, aimed at developing a socially-just approach to engaging students with science. Data are discussed from nine months of classroom observations of nine secondary science classes from six inner London schools (c.200 students, aged 11-15), interviews and workshop data from the nine teachers and 13 discussion groups conducted with 59 students. The approach resulted in some noticeable changes in practice, which were perceived by teachers and students to improve student engagement, cultivate a range of science-related dispositions and promote wider student participation and 'voice' in classes. Issues, limitations and possibilities for sociology of education theory and practice are discussed.

Sociology of education - beyond the critical secretary?

It has been proposed that a key role for sociology of education is that of the ‘critical secretary’ of society, speaking truth to power (or as Bourdieu terms it, ‘shining a spotlight on the blinkers’, 1990:16), recording both injustices and progressive/ counter hegemonic practices (Apple 2013, 2005). As Apple discusses, the sociology of education has made major contributions to understanding the reproduction of inequalities in education, with the majority of research in the field fitting this remit.

Yet, at the same time, this role has attracted some frustration from those both within and outside the discipline. Concerns have been expressed that critical work ‘can feel removed from everyday reality’ (Rowley, 2014 p.51) and that, while necessary, critical work can also be ‘depressing’, revealing issues that cannot be easily ‘solved’ (Gunter and Willmott 2002). There is arguably also a discernible gap between some of the more abstract, theoretical work and everyday educational policy-making and practice – and it is hard to see any substantive impact of sociology of education theory within current national government policy-making.

In this paper, we share our experience of an attempt at *praxis*, that is, the enactment of theoretical reflection and action (in this case, on classroom practice), with the hope of lending ballast to efforts aimed at more closely intertwining sociology of education theory and practice. We discuss the development and pilot of a Bourdieusian-informed pedagogical approach in London with teachers and students that aimed to foster more equitable participation and engagement with science among urban, socially disadvantaged students.

Our approach attempts to combine sociological critique with a commitment to ‘making a difference’ within the ‘here and now’ of everyday classroom contexts. We worked with teachers to collaboratively engineer an approach that might enable Others to speak (Spivak 1988), supporting more inclusive relations of representation and forms of subjectivity. Our attempt at praxis sought to work both within and against the pervasive dominant educational culture of neoliberalism and performativity (e.g. Ball 2003) because by working with ‘how things are’, we hoped to develop a pedagogical approach (in our example, for teaching science) that might have the potential to be both useful and achievable. In other words, we sought to follow Apple’s claim that, as sociologists of education, there is value and importance in showing that ‘there are things we can do right now’ (2013, p164).

‘Bourdieu doesn’t make for good bullet points’ – or does he? The possibilities for praxis

“Bourdieu doesn’t make for good bullet points” (‘David Megabland’, from ‘Interview with David Betterman’ FAAB, 2005)

In a satirical skit performed by the FAAB collective (a group of feminist sociology of education academics and activists who staged performance interventions c. 2005-2007), New Labour parody politician ‘David Megabland’ replies to accusations by his interviewer that policy fails to engage with academic research (and is not evidence-based) by complaining that sociology of education theory (as epitomised by Bourdieu) operates in an incompatible register from policy.

As Apple (2013) reminds us, critical sociology of education needs to be able to work in different registers – just as neoliberalism does. Apple usefully discusses this in the context of ensuring that sociology can talk with the dispossessed/ oppressed. In the interest of disrupting and shaping dominant practices and power relations, we would extend this argument further to argue that it is also important for the sociology of education to be able to talk in registers that can communicate with policy and practice.

Often the ‘recommendations’ arising from sociology of education work (our own work included!) includes calls to change (or radically overhaul) social power relations and ‘change society’ in fundamental ways. But what would this actually look like in practice? And does this necessarily mean we cannot enter into dialogue with policy and practice in the immediate, while acknowledging that substantial, longer-term change is a future goal?

A key tool here is the notion of *praxis*, that is, the enactment of theory in practice, combining both critical reflection and action. Freire (1970: 33) defines praxis as ‘reflection and action upon the world in order to transform it’, arguing that ‘through praxis, oppressed people can acquire a critical awareness of their own condition, and, with their allies, struggle for liberation’. While Freire concentrates on the liberatory potential for the dispossessed to develop critical awareness to precipitate action to change societal relations and inequalities, in this paper we explore a broader approach to praxis – as theoretically informed, collaborative, reflective dialogue between researchers and teachers to produce action/change that disrupts some dominant power relations and structures within science classrooms - opening up more inclusive possibilities for students in science (e.g. Calabrese Barton et al., 2008) -and builds non-dominant students’ capital (see Bourdieu & Passeron 1979).

Putting Bourdieu to work in the science classroom

Science classrooms provide an apt context for the study of inequalities. As a myriad of evidence attests, across most western nations there are stark and persistent inequalities in post-compulsory science participation, particularly in the physical sciences and engineering, where women, working-class and/or Black students remain persistently and starkly under-represented (e.g. Smith 2011; AAUW 2010). Critique has long been levelled at the dominant white, male, middle-class culture of science (e.g. Harding 1988) and attention has been drawn to the ways in which dominant, ‘celebrated’ practices and identity performances within science classrooms tend to be organised around prototypically masculine and middle-class ways of being (e.g. Carlone et al., 2011; Lemke 1990; Author 1 et al.). Whereas our previous work has focused on identifying and unpicking the intersectional ways in which injustices and power operate within science, to produce patterns of oppression and exclusion (e.g. Author 1 et al under review, forthcoming, 2014; Author 1 & Author 3 2016), in this paper we reflect on possibilities for change.

Our attempt at praxis is informed by Bourdieu’s theory of practice (e.g. 1977). From this perspective we understand ‘student engagement with science’ as occurring at the interface of encounters between habitus, capital and field. That is, we treat student engagement with science as a form of practice that is produced through a dialectical relationship between dispositions, capital and field and which plays out through students’ ‘strategic improvisations ... against a background of doxa that ultimately limits them’ (Parkin 1997: 376). For instance, we might expect quite different experiences of engagement between a student whose dominant group habitus and capital aligns with, and is recognised and valued by, the field of science education – allowing them to move ‘as a fish in water’ within the science classroom - compared to a student whose habitus and capital are misrecognised and denigrated (see also Calabrese Barton & Tan 2010; Calabrese Barton et al 2008).

Previously, we found that students who possessed greater amounts of science capital (but notably those forms with exchange value) were more likely to plan to continue with post-16 science (e.g. Author 1 et al 2014) and articulate (and be recognised by others as having) a ‘science identity’ (Carlone & Johnson 2007). Through further empirical and conceptual work, we identified a set of dimensions within science capital which statistically relate most closely to exchange-value outcomes relating to planned post-16 progression and science identity (Author 1 et al 2015). Following Bourdieu and Passeron (1977), we thus were led to wonder

whether there might be any potential for a social justice-orientated intervention, aimed at ‘building’ the science capital of students from non-dominant backgrounds (i.e. sharing out dominant/ privileged forms of capital)?

We felt that any form of intervention should be focused on trying to change aspects of the field, rather than the individual student per se (the latter being more common within human capital-orientated approaches, that tend to predominate in science educationⁱ), as ‘it is misleading to isolate factors from the system of relations in which they appear’ (Krarup & Munk 2016: 768). As Bourdieu reminds us, field ascribes the value of capital and is key to the re/production of unequal power relations: field determines the ‘value’ (or lack of) of a student’s capital and the relationship between a student’s habitus and field will shape the extent to which they experience science as being ‘for me’, or not (Author 1 & Author 3 2016). Focusing on field thus enables us to understand “how groups, individuals, and institutions are not so much defined by their objective attributes in themselves, as by their position in the structure of attributes” (Krarup & Munk 2016: 767).

We thus treat the science classroom as a field – a socially and historically constructed social-spatial arena, imbued with ‘rules’, within which differently positioned social actors struggle for the control of a range of (cultural, social and symbolic) resources. The science classroom is a ‘space of positions and position-taking’ (Bourdieu 1993, p30) and contains its own logic of practice.

A field is a structured social space, a field of forces, a force field. It contains people who dominate and others who are dominated. Constant, permanent relationships of inequality operate inside this space, which at the same time becomes a space in which the various actors struggle for the transformation or preservation of the field. All the individuals in this universe bring to the competition all the (relative) power at their disposal. It is this power that defines their position in their field and, as a result, their strategies. (Bourdieu, 2010, p. 37)

Of course, we were not expecting to radically overhaul the field per se, rather we wanted to try to explore whether it might be possible to shift some of the contributing and constituting aspects of the field, namely some of the ‘rules of the game’ and ‘exchange rate’, teacher-student relations and teacher-student relative positionality. Hence the intervention sought to engage teachers’ in reflective collaboration and support them to change their practice in relation to these key constituting aspects. Through these shifts, we sought to enable: (i) a

closer alignment between student habitus and the field of classroom science education, particularly for students from non-dominant communities and (ii) a broader eliciting and valuing and translation of non-dominant students' ideas, experiences and use-value capital within the science classroom. The former recognises the importance of respecting and representing the world views of minoritized communities within education (e.g. Freire 1970). This latter draws on a body of US work on 'funds of knowledge' approaches (Moll et al. 1992), which have been proposed as an equity-orientated, non-deficit approach to working with students from minoritised communities and which, as Rios-Aguilar et al (2011) discuss, aligns closely with a Bourdieusian understanding of capital.

We worked collaboratively with teachers (through group sessions and regular one-to-one reflection meetings) to develop an approach that was organised around *eliciting* students' ideas, experiences and use-value capital, *valuing* these and then *linking* them with science, with the aim of reducing the 'gap' between student habitus and the science education field and enabling/ supporting the potential for the translation of use-value capital into exchange-value capital (e.g. scientific literacy, particular scientific dispositions and practices). We were interested to see if it is possible to alter the 'exchange rate' within science classrooms (Rios-Aguilar et al 2011: p177) regarding which forms of capital are recognised and legitimated. Of course within this task we recognise the inherent limitations (being mindful that "it is unlikely that such intervention can match the comprehensive structure of benefits enjoyed in more advantaged positions", Krarup & Munk 2016: 766). By welcoming and valuing more diverse ways of 'doing science' within the classroom (e.g. what 'counts' as science, valued ways of performing scientifically) we hoped that the intervention might edge towards a wider goal of reconfiguring the dominant culture of science within these nine teachers' particular classroom spaces, opening up more inclusive ways for students to identify with and participate in science, reworking the dominant cultural arbitrary of science.

In this paper, we reflect on the affordances (or otherwise) of our Bourdieusian-inspired, pedagogic approach ('the intervention'), asking specifically:

- How did participants experience the intervention's impact on student engagement? (in terms of interactions of student habitus, capital and field)
- What is the emancipatory potential? How was the intervention perceived to effect student 'voice' and participation?

Methods

The data reported in this paper come from a nine month research and development project that was conducted with nine teachers from six inner London schools as part of a longer, five year [*project name*] study. Three of the participating schools (Coleville, Mareton and Northfields) were approached on the basis of being state-run, co-educational and within \pm 20% of the GCSE¹ results of other schools within their local area, with high proportions of students eligible for free school meals, reflecting the aims of the wider project to understand engagement with science education among students from minoritized (non-dominant) communities. In each of these schools, two KS3/4 (students age 11-16) science teachers were invited to volunteer to take part in the study (i.e. teachers who teach at least one class in the 11-16 age range). The remaining three participating teachers (who taught at a further three different schools, two co-educational and one single-sex) had previously taken part in a professional development course that had been conducted in an earlier phase of the project (see Author 5 et al., 2015) and were invited to participate as they had expressed an interest in being involved with future project phases. Details on the participating teachers and their classes are provided in Table 1.

Table 1 about here

As detailed in Table 1, our sample comprised a spread of year groups (1x Y7 class, 3 x Y8, 3x Y9 and 2x Y10) and set groupings (4 x bottom set, 2 x middle set and 3 x top set). With the exception of students in Ms Smith's school, students came predominantly from working-class backgrounds and a range of ethnic backgrounds. Urdu/ Bengali, Turkish, Polish and Portuguese were the most frequently spoken community languages among the students.

The core data drawn on in this paper come from field notes of classroom observations, a teacher workshop, teacher interviews and discussion groups with students.

Observations. Each class was observed by one or two researchers over the nine month period (September to June). Researchers attended classes approximately every c.3 weeks over this time. Researchers usually sat at the back or the side of the classroom and recorded field notes either by hand (pen and paper) or on a lap top computer or iPad. For our observations we used an ethnographic approach, following an observation guideline that had been developed and agreed by the research team, including recording how students behaved, what

¹ GCSE's (General Certificate of Secondary Education) are series of exams students take in the UK when they are 16.

they were doing during the lesson, what they said, how they interacted with the teacher and peers and whether they appear to be engaged with particular aspects of the lesson, or not. We also noted observed group dynamics, which students were being more or less dominant, facilitation from teachers and the content of student discussions as well as other events of note (Hammersley & Atkinson, 1997).

Student discussion groups. Towards the end of the field work period (April – May) we conducted 13 discussion groups with 59 students – as detailed in table 2 – aimed at eliciting students’ experiences of the intervention. Discussion groups were conducted in a quiet space (usually an empty classroom) during class time and varied in length between 20 minutes and 1 hour, depending on the time available. Potential student discussion group participants were identified and grouped by teachers, dependent on parental consent to participate.

Table 2 about here

Teacher workshops & interviews. Teachers took part in two day-long Saturday workshops, one in early Autumn at the start of the project (covering the study scope and approach) and one mid-way through (in February). The workshops supported teachers to share their experiences, raise issues, collaboratively design and refine their approaches and reflect on emergent themes and data presented by the researchers. Workshops were audio recorded and observed by three members of the research team who made extensive field notes on what was said and the interactions between teachers during both small group and whole group discussions. All the participating teachers attended. Teachers were also interviewed (audio-recorded) at the beginning and end of the year.

Ethics. Consent was obtained from teachers and school managers. Parental and student consent was obtained to report and use the data for participating students.

Findings

Our observations recorded substantial and prolonged change in teachers’ practice over the course of the academic year. For instance, we observed teachers increasingly ‘tweaking’ their usual lesson plans and schemes of work to incorporate ideas for fostering student attitudes and dispositions (e.g. that ‘science is everywhere’), inviting a broader range of ways of ‘talking science’ (Lemke 1990) and eliciting regular and sustained links between science content and students’ everyday lives in and out of school. In their interviews, all the teachers

recounted their perceptions of substantial change in their personal development and practice. As Ms Smith put it, “that’s been a best part - you know it really has changed how I teach”. The majority of students in the discussion groups also reported a discernible change in practice that was enacted consistently over time and which involved a more contextualised approach to science teaching that went beyond the ‘usual’ content coverage (which students termed “going off topic”) and drew on students’ use-value capital (e.g. “she teaches you based on what you know”). We now discuss teachers’ and students’ views on what impact these changes had on student engagement and ‘voice’.

RQ1. How did participants experience the intervention’s impact on student engagement? (interactions of student habitus, capital and field)

We begin by reflecting on teachers’ and students’ accounts of the impact of the intervention on student engagement (i.e. how the intervention shaped the students’ experiences at the interface of habitus, capital and field) before moving on to consider more specific shifts in habitus and capital – and whether the intervention might be considered as ‘building’ student capital, or not.

Perceived influence on student engagement

As discussed earlier, we understand ‘student engagement’ as a form of practice that is produced at the interface of habitus, capital and field and which involves students’ ‘invention and improvisation’ (Bourdieu 1990: 13), albeit within the constraints of structure. All of the teachers felt that the intervention had made a positive impact on student engagement (e.g. “I think they’re much more engaged with the science”, Ms. Arkwright) and articulated a range of practices that they felt had shifted. In particular, both teachers and students felt that the changes produced (or were associated with) forms of student engagement that involved ‘excitement’, ‘interest’, ‘focus’, ‘attention’ and ‘active’ classroom participation (indicators of engagement that are recognised in the wider literature – e.g. Ainley & Ainley 2011; reeve 2012), as noted through researcher observations and as detailed in the views of participating teachers and students.

For instance, teachers and students commonly described how the intervention had increased their *interest in and enjoyment* of science lessons, as students experienced science classes as being more ‘fun’, ‘enjoyable’, ‘creative’, ‘lively’ and ‘interesting’. For example:

The boys have really enjoyed it, yeah. I've really enjoyed it (Ms. Smith)

It makes the lessons fun (Tanisha, Mr Hobbes class)

I think that makes the lessons more lively (Fawaad, Ms. Arkwright Class)

Like, it's really creative, like the lesson plans that she gives us, which like make it more enjoyable, (Amya, Ms. Arkwright's class)

Some students also explicitly articulated how specific aspects of the approach (e.g. linking to particular dimensions of science capital), were key to this increased interest and enjoyment. As Hendrix (Ms. Randel class) put it: "like she's linking it [science] to jobs that we can have, that was quite interesting".

As discussed further below, teachers also noted increased student attention, motivation and focus ('on task' behaviours) and described how students were more actively involved in lessons as a result of the intervention, a point that was also borne out by our observations, which recorded students participating more and showing more active attention when teachers were using the approach. As Ms. de Luca explained:

"So [Y10 bottom set] are a very challenging group of students [...] Through the year what I've noticed is when [I use the approach] I can see it their eyes ... they kind of ... like a meerkat, they pop up and you can see the engagement and you can see that they talk about it a bit more. (Ms. de Luca)

We suggest that these 'meerkat' moments, when student sit up and take an interest in the class and participate more actively (e.g. 'they talk about it a bit more'), might be understood as generated by students' experiences of a closer alignment between their habitus (identities and dispositions) and field and through the field's increased valuing of their use-value capital. As the following extended quote from Mr. Okello illustrates, this may be because the approach provides students with more legitimate spaces and opportunities to 'express themselves or their ideas'. This in turn was felt to inflect dispositions, e.g. leading students to 'value science' more:

The big difference has been their engagement and their interaction with the lesson... especially if kids can talk about their experience, express themselves or their ideas – I find they're far more engaged and they value it a lot more.[...] When they're talking about something you can see they're happy, they're excited. When they do tasks,

they want to get it done and they want to tell everybody what they've discovered or their answer, or what poster they've made. So they're eager to share, they're eager to show (Mr Okello).

As Mr. Okello suggests, as well as being 'happy' and 'excited', he feels the intervention has contributed to producing practices that are inflected with agency and traces of pride (students are 'eager to share ... eager to show'), hinting at a potential closer alignment between habitus, capital and field. We now dig a little deeper into the potential ways in which teachers and students indicated that the intervention may have shifted the recognition of capital and student habitus.

Perceived gains in capital: improved competence and understanding

There were two main forms of exchange-value capital that students and teachers highlighted as potentially being 'built' through the intervention, namely student 'understanding' and 'attainment'.

The majority of students and teachers felt that the approach increased student understanding of science. The teachers felt that the approach helped their students to grasp concepts and ideas more quickly and to retain the information for longer. Across the board, the main benefit identified by students across the discussion groups was that it was felt to help students to better understand, make sense of and remember lesson content – or as Fatima (Y7 girl, Mr Hobbes' class) put it, "so it stays in our head even more". Her teacher concurred:

Yeah I think it has increased their understanding. Like with the lesson today, like I wouldn't be able to repeat things that I've taught before to them because it would be like 'Huh? I don't actually understand this'. (Mr Hobbes)

"Yeah, it's a better way to make us remember things. Like it's not like a boring way of like just reading and then trying to get it into our heads (Tahir, Ms. Enoh's class)

The reason for this increased understanding was explained as due to the linking of science content with students' own lives, which students felt enabled them to both understand concepts and meaningfully connect with the content (which we could interpret as reducing dissonance with the habitus), which made topics more 'memorable':

So it kind of like lets us relate to what she's actually talking about ... so we can understand it more [...] It helps because we can get a picture straight away ... so if you relate it to what we're doing, you just get the concept quicker. (Rohan, Ms. Randel's class)

I think it's like quite cool, 'cos then you like think about it and then you're like, 'oh yeah, that's related to like everyday life' and you're like, 'I'll remember that now' and you shall remember it. (Christopher, Mr. Okello's class)

Yeah, I feel like we get a better understanding because we can relate to what she's teaching us (Alfie, Ms. Arkwright's class)

We suggest that student 'understanding' of science can be understood as a form of exchange-value cultural capital in that it is form of scientific literacy - a high status form of knowledge and/or competency that can have many applications, including translation into formal qualifications. The students' accounts suggest that linking science with their lives enhanced and improved their engagement, which we interpret as due to a reduction in the 'distance' between science content and student habitus.

Attainment

Whereas teachers and students were largely in agreement as to the benefits of the approach for student understanding of science, views were much more ambiguous and divergent regarding whether it also raised attainment. Due to the differences between schools, year groups and curricular, we were not able to deduce a common measure of attainment that would make sense across the participating classes. Instead, we asked teachers for their impressions and reflections (based on their intuition and the data available to them) as to whether the approach had generated any attainment gains. Only two teachers felt that it had generated gains in attainment:

It has been better than the target, they've been given like D to E targets but now I'm expecting at least 50% of the class grade C [...] I think it did have some impact because we started off expecting, you know, very poor grades from this group, and I'm really surprised that they have done extremely well over the year when I looked at their overall result ... much better than we've actually predicted (Ms. Dennis)

I think if you think about this statistically compared to your other classes, I was quite proud of them because they made ... numerically they made really good progress ... they have grown a lot like throughout the past 9 months. And I can see like they are thinking about their answers (Mr Hobbes)

The other teachers were less sure, or more ambivalent. For instance, Mr Okello felt that the approach did not produce any gains in attainment in terms of test scores. Although he also reflected that summative assessment does not necessarily represent the wider range of understanding and skills that students might develop:

The way we assess students with our summative tests, I think science capital doesn't necessarily make them better at that, but it does increase engagement ... those tests cater best for kids who can retain a lot of information and grind through a lot of data just before their exam or the test, and I don't think [they] necessarily reflect or show some of the more important skills that we'd like [students] to develop.

Changing student dispositions?

We were also interested in whether the intervention might foster changes in particular aspects of habitus and capital, namely student dispositions associated with symbolic (exchange-value) dimensions of science capital. Teachers and students from across the discussion groups recounted changes in student dispositions, primarily in relation to understanding the presence and value of science in everyday life. For instance:

So some kids got engaged with science. Some of them told me at the start of the year that 'oh, we didn't learn anything last year, we are not even sure why we're doing Science' ... da-da-da. So at the start of the year I found some of the attitude like really difficult to deal with because some of them did not care. But as the year progressed they started picking up and some of them actually started showing some interest, yeah. [...] some of them told me 'oh miss, we're really starting to enjoy Science now' [...] I mean the progress that I've seen with some of them is ... I think that's the biggest achievement. (Ms. Enoh)

It's opened their eyes quite a lot ... they're more engaged, they like to be able to think a little bit outside the box and link it to their lives ... and from that they can see the value of it (Ms. Arkwright)

We also noted a widespread expression among the students regarding an increased appreciation of the value of science in everyday life. For instance:

Its better bringing real life examples into a Science lesson cos it's more interesting. And you can like understand the fact that behind everything in the world there's still science behind it. (Daniel, Ms. Enoh's class)

I think it's helpful because it helps you like see what, why you need to have an x-ray and stuff like that. (Maryam, Mr Sharma's class)

I think it's more like interesting because you have an idea of where it might come up in your daily lives, whereas in other Science lessons or like in the past, when someone said something, you're like, oh, it's just that, like it won't come to your use. (Shona, Ms Arkwright's class)

A small number of students indicated that there had been a change in some of their out-of-school attitudes and practices, such as more frequent discussion of science with their families. For instance, Ashanti (Ms. Dennis' class) described talking with her father about specific topics she had learned in science class.

Several of the teachers also reported that students and/or parents had reported back to them that they now talked about science more at home. As Ms. Smith explained:

[They] definitely felt a relevance of what I teaching them to, you know, decisions that their parents had made ... [for example] why you shouldn't just use antibiotics all the time. That worked really well. I really do think most of them did have a conversation round the dinner table, you know, yeah ... that was really good.

A couple of students also reported changing aspects of their everyday behaviours, in line with something they had learned about in science class which they felt had connected with their daily lives. For instance, after a class on radiation, Kosoko explained:

Every time I have my phone, like straight away I see that my phone's in my ears for a long time or just a bit of a long time, Ms Enoh's lesson always comes to mind. I always put it on speaker like, most of the time. But when my phone's on a charger for example and I'm holding it something like that or if I sleep with headphones or something like that, it just comes to mind, so it links to everyday life pretty well.

A few boys from Ms Arkwright's class described watching more science-related media now, such as TED talks, and most students from across the schools indicated a greater appreciation that science can lead to a wide range of jobs. For instance,

I think that it's helpful in a way, because not many other lessons like link jobs to the subject, so it like helps you understand. (Shona, Ms Arkwright's class)

A few students also spontaneously mentioned examples of how they now used their school science knowledge and skills within their daily lives. For instance:

"We actually use it [science] in our lives. Compared to other teachers, they just tell us, that's it, we move on, whereas [Ms Arkwright] tells us and then we actually learn from it and implement it in our lives". (Brody)

"I went to Curry's to buy a TV and explained the energy and stuff to my Dad, so now we're saving even more money" (Fawaad, Ms Arkwright's class)

As Bourdieu & Passeron (1977) explain, schools can be socialising agents and can shape student dispositions in various ways. The above examples illustrate how this process might also occur at the micro level of the classroom, potentially developing particular attitudes and dispositions relating to perceptions of the value of science in everyday life. Of course, how durable (or not) these changes might be is hard to assess – although we speculate that longer-lasting dispositions would probably require longer-term pedagogic action to embed. For instance, research by Carlone et al (2011) shows how students' science-related identity and dispositions can vary dramatically from year to year, depending on the class teacher's approach.

Challenging views

Although the majority of students expressed positive views about the approach, a couple of students were more ambivalent. Although she admitted to liking the approach, Joya also worried that the real life contextualisation sometimes meant that they were not covering the 'real' science content:

Like, half I like it and then half maybe it's a bit of a waste of time [...] I think we miss a lot of the lesson, so most of the time, if he does say his stories, it will take

about .. about 20 minutes, something like that, so it kind of takes a lot of time [...] but I quite like it at the same time (Joya, Mr Sharma's class)

Likewise, Amya reflected "it's helpful ... but it sometimes takes your mind off the actual thing that you're actually doing". We suggest that these students' accounts could be read as signalling how the approach might rub up against the demands of educational performativity, in which the coverage of content and examination preparation is considered the 'real' focus of learning. Moreover, we suggest that these examples highlight how any attempts to challenge and shift prevailing norms about 'how things are' and how learning 'should' be done (*doxa*), will invariably meet resistance.

RQ2. What is the emancipatory potential? How was the intervention perceived to effect student 'voice' and participation?

One of the aims of the approach was to open up spaces for more students to 'do' and participate in science, broadening both 'who speaks' and 'what is spoken about' (whose and what knowledge is valued). Hence we were interested in teachers' and students' views as to whether it had engendered any changes in classroom dynamics and participation – but particularly public oral contributions and student 'voice' within the classes. This reflects our concern that a focus for social justice work within education is changing the conditions to enable the Other to 'speak' (Spivak 1988) and to redistribute capital among non-dominant communities. The approach sought to support teachers not only to make regular use of student peer discussion, but also to encourage a wider range of participants and 'types' of contribution (based on students' own lives). Some teachers were already making use of student discussion, whereas for others it was a newer departure, which was achieved to varying extents:

So I've kind of also learnt that when they talk I have to be careful when to stop the talking because I know some of the talking is actually them discussing the science, and it's their engagement and they want to sort of feedback to each other. I know students learn from talking, but usually I kind of ... I'm very strict and I will shut them down very quickly. Whereas now I kind of give them a bit more space to talk because I know that it's helping them to relate and engage more with the topic" (Ms. de Luca)

In terms of broadening student participation in class discussions, we observed a range of participation between the different classes, varying from predominantly ‘inclusive’ classes, in which most students spoke most lessons (e.g. in Ms Arkwright’s class) through to classes in which a few students tended to predominate and a few spoke infrequently (e.g. Mr Sharma’s, Mr Hobbes’). However, across the board, we recorded various instances when enactment of the approach seemed to encourage a wider range of students to voice their views in class, particularly among those who were traditionally very quiet and tended not to participate publically. For instance, during a lesson on vibrations Mr Okello elicited students’ everyday experiences around the topic, during which Christopher, a very quiet boy who did not normally contribute in class, offered his experience of his grandmother, who is deaf and is more sensitive to vibrations. That is, while the approach did not shift classroom dynamics completely, when enacted, it did seem to promote hopeful possibilities for inclusion.

All the teachers felt that the approach had helped to broaden and increase the contributions and participation of a wider range of students within their classes, but particularly among ‘quieter’ and lower attaining students. For instance:

Yeah, it definitely ... for the boys who didn’t want to really talk in class ... that did work. For the boys that got sort of enveloped by other boys. (Ms. Smith)

Generally I think I get overall more participation purely because of science capital, that’s what I personally feel [...] Since I’ve started using science capital they’ve been able to engage far more in lessons than they normally would and so now they’re like ‘Oh it’s my favourite subject, I love science, I want to do more science when I’m older.’ (Mr. Okello)

Students in the discussion groups also described the approach helping to foster more inclusive participation in class. For instance, Fawaad felt it fostered a more “friendly environment”, which he believed also helped his attainment (“like, I improved more this year, like last year, I wasn’t doing as well, but then this year, ‘cos I think of the learning environment and the way we’re taught, it’s improved”). And as Daniel (Ms. Enoch’s class) explained, the linking of science content to personal experience opened up a wider range of ways for students to participate in and contribute to the class:

If she’s [teacher] explaining something she’ll give like an example that everyone could relate to, and everyone’s like ‘Oh yeah’. And then they’ll say something, then

someone else will say something. And then quite a few people have something to say. And then it's like 'Oh yeah, so we've experienced it' so yeah.

We interpret these students' accounts as illustrating how the eliciting and valuing of students' use-value capital within the classroom might help promote student 'voice' and participation. This could be particularly valuable within a subject like science that is dominantly associated with bodies of factual knowledge that demands a 'right or wrong' answer and which is popularly associated with public demonstrations of 'braininess' (e.g. Author 1 & Author 3 2016; Lemke 1990). From a Bourdieusian perspective we might say that these moments represent a shift in the field, in which students can speak in a wider range of registers and in which some of their use value capital is recognised as legitimate ways to engage with science. That is, a wider spectrum of students were recognised as authentic contributors and as having "something to say" (due to the valuing of their lives and experiences as legitimate sources of science-related knowledge and experiences).

Yet, despite these promising moments, wider inequalities and patterns of participation remained and observation plus several teachers and student discussion groups recorded how some students still remained scared or shy of participating in class. For instance, Mr Hobbes reflected that although the participation of the girls in his class had improved, they were still 'very quiet'.

Discussion & Conclusion

In this paper we have discussed our experience of working with nine London teachers to develop and implement a Bourdieusian-inspired attempt at praxis in the context of secondary science education. We did so based on a belief in the conceptual and social justice value of bringing theory to bear within attempts to engage with (policy and) practice. We thus advocate for a sociology of education that both 'gets its hands dirty' - engaging with the thorny task of how we might (attempt to) improve things on the ground in the here and now - alongside 'higher level' critique. This marrying of theory and practice was something that our teachers also explicitly valued:

I knew that there's something to this, that there is something that is of value. Because you know sometimes with some research it's a lot of ... it's all well and good in theory, but in practice it doesn't always work. So with this when I could see that

actually the theory put into practice there is something to it. I thought okay just persevere, keep going with it (Ms. de Luca)

Teachers, and many students, described their experience of the approach in largely positive terms, suggesting that it enhanced student engagement and participation in a range of ways, but particularly for students from non-dominant communities. As one teacher put it:

So I would say ... it is very, very important especially if you want to engage kids that are not very inclined to science - science capital, it's a good way of doing it. Yeah.
(Ms. Dennis)

The basis of the approach - eliciting, valuing and link students' 'funds of knowledge' (use-value capital) with science - has been advocated by others as a good basis for social justice approaches to re/designing formal education. (e.g. Basu and Barton 2007; Zipin 2009). Drawing on Delpit's (1995) two-directional approach for a social justice approach to educating Other children, Zipin argues that there are various benefits to employing a FoK approach, not least challenging 'the exchange-value power by which competitive academic curriculum selectively privileges cultural capital embodied in elite social-structural positions' (Zipin, 2009, p. 317):

'the *redistribution* impulse is crucial to enable academic success that leads to pathways beyond poverty, ill health and more. Yet the *recognition* impulse is even more vital, both ethically to keep diverse cultures alive, and pragmatically, to *engage* learners through familiar social-cultural resources' (Zipin 2009: p318-9).

We also suggest that approaches which, in the words of our teachers, make them 'happier' may hold promise for a range of reasons (see Author 4 et al, forthcoming, for a discussion of the implications of the approach for teacher agency and pushing back against educational performativity).

We thus identified a range of potentially 'hopeful' outcomes, including improving student engagement and understanding, building student science capital, fostering a range of science-related dispositions and practices and widening classroom participation. However, we also recognise that the potential of the approach is constrained in a number of ways. For instance, following our Bourdieusian framework, we might question how effective attempts at the redistribution of capital can actually be when enacted within a system in which wider power inequalities remain intact. From a Freirian perspective, the liberatory and 'humanizing'

potential is also undermined given the lack of social critique within the approach. Moreover, we may question the longer-term impact of the approach if it remains isolated in particular classes, rather than, for instance, being embedded more widely.

However, we would argue that the alternative - to do nothing and not attempt any form of intervention – is also untenable and maintains the status quo. As Freire (1970) reminds us ‘hope ... does not consist in crossing one’s arms and waiting (p.73). In this sense, we argue that there is a value in attempting ‘small gains’ through pragmatic approaches (e.g. that attempt to enable minoritized students to play a better ‘hand’ in the ‘game’ of educational reproduction), while also speaking truth to power and calling for more radical, ‘longer term’ visions for a socially just society and education system.

We do not seek to over-claim for our approach – it remains a small-scale, exploratory foray into some possibilities for praxis. The data we discussed focused on teachers’ and students’ perceptions and experiences of the approach, rather than, for instance ‘harder’, e.g. quantifiable, measures. We sought to understand participants’ experiences of the intervention, because we believe this is useful and valuable both practically and conceptually. This exercise revealed that teachers and students generally saw value in the approach – but it also raises further questions, not least questions of scale-ability, given the resource-intensive and relatively long-term nature of the intervention (working individually and collectively with teachers over a nine month period), especially within the prevailing climate of tight budgets within UK education and the restricted time and money available to support teachers’ professional development. This is something that we will continue to think through during the next iterations of the project (being conducted, at the time of writing, in partnership with the National STEM Learning Centre and centres for initial teacher education).

In sum, we hope this paper might contribute to further discussion within the sociology of education regarding what might be achievable in the ‘here and now’ of contemporary UK education in terms of working collaboratively with teachers to improve the experiences and chances of *all* students. But we also hope it might add to efforts to demonstrate the wide potential value of sociology of education for policy – as both a critical voice speaking truth to power and as a ‘critical partner’, offering ideas for how things might be ‘done differently’ in the ongoing struggle for a more socially just education system.

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ⁱ For instance, commonly approaches focus on trying to improve scientific literacy (e.g. support people to understand and learn more science content/ knowledge).