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The teaching of higher education mathematics by pre-service mathematics teacher educators: How might this contribute to social justice? A consideration of a possible approach

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This paper considers the teaching of higher education mathematics as part of pre-service teacher education and the potential for it to contribute to social justice. In it I ask and seek to offer one possible answer to the following question: By enacting within their own higher education mathematics teaching an enquiry-based pedagogy informed by considerations of fairness and equality, can mathematics education tutors open up possibilities for their students to engage more deeply with such practices and the attendant commitment to social justice? A set of exemplar practices drawn from my own teaching is briefly described and discussed and responses from a cohort of students considered.

Keywords: Neo-liberalism, mathematics education, pre-service teacher education, activism.

Introduction

Socio-political researchers in mathematics education have connected active, engaged, meaning-making pedagogies with the possibilities for social justice in school mathematics classrooms (Skovsmose, 1994; Gutstein, 2006; Boaler, 2008). Although there is a rich literature about innovative and critical approaches to other aspects of pre-service teaching (for example, Cochran-Smith, 1991; Nolan, 2012), there has been comparatively little written about the impact of such pedagogies on those teacher education students who study academic mathematics as an undergraduate subject in its own right. We know that talking about and recommending practices that go against the grain (Cochran-Smith, 1991), whilst essential, have, in themselves, comparatively little effect in teacher education (Nolan, 2012) – but that, in other educational contexts, *enacting* recommended practice may do so (Alexander, 2008).

In England, over the last three decades, neo-liberalism has been successful in colonising educational discourse to such an extent that we are left with just “the rubble of words” (Berger, 2016, p. 7)¹. It becomes almost impossible to think outside neo-liberalism’s world view and, therefore, to think how things could be otherwise (Llewellyn, 2017): Our human priorities have been “systematically sprayed, not with pesticides, but with ethicides – agents that kill ethics and therefore any notion of ... justice” (Berger, 2016, p. 83). Education has been marketised as a consumer good and no longer understood as a moral enterprise, leading to relentless managerial auditing ruthlessly imposed and internalised by practitioners who have to constantly remake themselves as neo-liberal individuals (Povey, Adams & Everley, 2017). I argue that offering the experience of countervailing ways of being in the world (often momentarily) can open up other ways of *thinking about* and *acting in* the

¹ Space allows for only a brief statement of these ideas here and in the next paragraph. See Povey & Adams (2018) for a fuller argument.

world: “Revolutions are about little things. Little things which happen to you all the time, every day, wherever you go, all your life” (Rowbotham, 2000, p. 211). Routine preservice classroom practices are part of this everydayness.

In this study, I largely bracket, for the time being, whilst accepting them as always already essential for critique, a set of difficulties and dilemmas present in any critical engagement in socio-political mathematics education research. In capitalist societies, inequity and exclusion are consubstantial with the acts of teaching and learning mathematics (Pais, 2017). Mathematics itself creates pernicious collateral damage (summarised in Povey & Adams, 2018, and developed in some detail in Ernest, 2016, and Skovsmose, 2016). Nevertheless, as well as critiquing existing patterns of inequality, I intend my research and writing to contribute to the struggle for a more just, democratic and socialist mathematics education, to enable us to act in the world, however necessarily unstable and temporary that positioning and analysis may be. My project is an activist one, not functioning as we are supposed to do as researchers (Straehler-Pohl, Pais, & Bohlmann, 2017, p. 13) but otherwise and utopian in seeking to catch an occasional, penumbrian glimpse of “the speculative could” (p. 3).

This paper asks: *Can teacher educators, by enacting the approach considered here, open up possibilities for their students to engage more deeply with (and therefore perhaps adopt) such practices and the attendant commitment to social justice?* Neo-liberal discourses regulate practices (Nolan, 2012), reproduce existing class relations and valorising being “strong and selfish” (p. 210). Can we enable our students to reassert in education a moral landscape of autonomy and trust (Stronach, Corbin, McNamara, Stark, & Warne, 2002, p. 130), an interpersonal enterprise contributing to understanding how we should live and challenging hegemonic neo-liberalism?

My practice

There is a categorical difficulty in trying to represent practice given its “dense, continuous, expressive nature” (Coldron, 2013, np.). Practice, a set of “socially produced, culturally constructed activities” (Holland, Lachicotte, Skinner, & Cain, 1998, p. 41), can probably only be properly conveyed by the practice itself. Nevertheless, it is expressed and mediated by spoken discourse, materiality and embodied practices: It is opened by and entered through *artefacts* (Holland et al., 1998, p. 251) which assume and express *intentionality*. In this case, the mediating artefacts include:

- *my language and the implicit and explicit rules I set up for classroom talk* – for example, discussing and disallowing talk about people as ‘clever’ or ‘able’ or, including about oneself, as ‘useless’, ‘thick’ or ‘stupid’, encouraging talk which is collective, supportive and reciprocal; welcoming mistakes and queries as prompts for thinking rather than worrying about being wrong;
- *the physical space for studying* – for example, preparing the room with mathematical posters and frequently taking in eye catching and intriguing objects to promote inter-cultural respect and the awareness of possibilities of communicating mathematics outside a common vernacular; arranging tables in groups of about six;

- *promoting collaboration across the whole class* – for example, putting students in heterogeneous groups chosen by me; restructuring each time a new topic is introduced; discussing my research-evidenced conviction that this supports building a learning community; requiring that everybody in a table group must understand before the group moves on;
- *questions or other responses where answers might be expected* - for example, developing a sense of themselves as being sources of authoritative knowing when they look to me for conventional 'help' and it is not forthcoming and offering instead, say, 'Can you apply that reasoning to this one?', 'How does what he is saying connect with what we were discussing last week?', 'You two don't agree - excellent - an opportunity for mathematical argument!'
- *the tasks set* - for example, ensuring that they are group-worthy; adapting the curriculum according to students' responses;
- *the pattern of attendance* - for example, making some sessions explicitly optional and others justified as essential, required for honouring and contributing to the learning community; allowing extended periods for an enquiry;
- *the physical objects used* - large, colourful physical models, shared task recording sheets, cards to be flexibly sorted and organised rather than static texts, erasable short-term responses to group questions;
- *characteristics of the final assessment* - for example, open book where students can take in anything except things that connect with the internet; more marks available than needed so that any work submitted can be rewarded.²

For almost all of the students, the effect of these mediating practices in mathematics education is “a totally new experience” (interview data).

The study

This action research case study offers a “serious example” (Skovsmose, 1994, p. 9) of practice, that bundling together of “co-dependent (mutually constitutive) sayings, doings, understandings, physical arrangements, purposes, feelings, roles and identities” (Coldron, 2013, np.). It is framed within my “living education theory” (Whitehead, 1989, p.41), undertaking research as thoughtful practice. I have been teaching very similar mathematical content with very similar intentions to very similar students for many years and the theory which guides my practice has become embodied and enacted with increasing complexity over time. McNiff and Whitehead (2010) describe the process thus:

Because you are a living person, you are changing every day; and because you are reflecting consciously on what you are doing, and making adjustments as you go, your theory is also developing with you. Your theory is part of your thinking and living, which is continuously transforming. So your theory, as part of your own thinking, is living... In living educational

² For much greater detail and exemplars see Povey (2017).

theories the explanations are produced ... in the practice of enquiries of the kind, 'How do I improve what I am doing?'. (pp. 252–253)

I used interview data from students to explore their experience of and reaction to my practice. The participants were from a class of 40 who were following an undergraduate pure mathematics module comprising a third of their final year study taught within a mathematics education centre by staff who had been school teachers (Povey & Angier, 2007).

The group interviews, each of which lasted about an hour, were conducted by a researcher unknown to the participants using a very open, semi-structured protocol. I explained the purpose of the enquiry in writing, making it clear that they were under no obligation to take part and could withdraw from the study at any time. I assured them that all data would be reported anonymously unless they specifically requested otherwise. I guaranteed that the data would not be viewed by me until I had finished teaching and assessing them, hoping in this way to address the ethical issues involved. Everyone in the class agreed to be interviewed but logistical constraints during a pressurised time of year meant that only eighteen ended up being able to participate. Overall, the groups were heterogeneous and not composed of friendship subgroups from the class.

The interviews were all transcribed by an independent transcriber (with occasional editing for clarity and brevity). The initial analysis, despite being careful and systematic, was iterative and somewhat 'messy'. I worked with the transcription texts, reading and re-reading them many times, tentatively extracting what seemed to me to be interesting and coherent passages of dialogue. I printed each of these onto a separate sheet of paper and physically grouped, de-grouped and re-grouped the sheets, searching them and annotating emergent themes. I did not identify the individual participants in the transcripts at this stage in order to gain a little distance from the texts. I then listened to all the tape recordings more than twice, attempting "radical listening" (Clough & Nutbrown, 2012, p. 99), immersing myself in the full data set to gain a sense of how the emerging themes were, or were not, grounded in the data. I then repeated the initial process of working with the transcripts, checking out and supplementing the existing themes and looking for new ones. No new themes emerged but some were modified and/or enriched. Finally, I referred to my record of which students had participated in which group interview and listened carefully to the tapes for a final time in order to identify the participants in the extracted passages.

Analysis

The interviews were cultural spaces where the students, through improvisation, articulated an understanding of their experiences of the module. In analysing them, I asked to what extent and in what way (i) my "living theory" was visible to them and (ii) they were willing to experiment with embracing aspects of it in their sense of who they were becoming. All but one suggested some such identification. After interrogating the data, I identified a number of themes which there is no space here to discuss. Rather, I present extracts from the data which link to just one aspect of working for social justice in and through mathematics education, that of experiencing solidarity.

Solidarity involves *challenging the discourse of 'ability'* (Marks, 2013) and destabilising attendant hierarchies, offering equal value and equal respect towards each other.

Anna: I think we're all on kind of a level as well. Like we all have obviously our strengths and weaknesses in certain areas, but they're all different so we can actually get that collaborative kind of thing that everyone's talking about.

Matt: There's one example where the vast majority of all the groups thought one particular answer was correct and then one person disagreed and that person was the one that got it right... that's kind of a bit of an indicator... It's not the fact that 95% have got it wrong. It's the fact that one person got it... it's almost like reverse psychology... instead of feeling left out because you're the one that hasn't got it right, it's like everybody else thought 'we can do it as well' ...Does anyone know what I'm trying to say there?

Rach: ... Because you've got a group mentality you sort of think 'One of us has got it so between us we've managed it and with a little bit of work it's not out of reach for us all'.

Developing links *in a learning community* expressed metaphorically as being a family (comp. Angier & Povey, 1999) becomes a shared preference and brings *pleasure*:

Anna: It encourages a different way of working... you don't get the chance to work in a group very often normally for maths. It's seen as a very solitary subject, but I think it makes it a lot more interesting and a lot more enjoyable when you can sit and work with people on a subject and on a problem particularly.

Will: I do like it a lot better ...It's more like a little family, ain't it?

Rach: There's a lot of us who will come into uni when we haven't got set lectures... because we want to sit and work as a group of us rather than sitting at home doing the work...

Int: Would you have done that before?

Rs: [*several*] No, no never.

They appreciated that the nature of their tasks supported this. These group-worthy tasks and the discourse of collaboration are used by the students to position themselves as agentic in the face of doubt or difficulty. Such a sense of *agency and authority* has been found to be a central characteristic of those mathematics teachers who were able to interrogate taken-for-granted practices in schooling and work for progressive change (Povey, 1997). The approach to answers plays a part in developing their shared conviction and authority.

Dora: I think a lot of the tasks though because they're quite open-ended, it's not stuff you can do individually. You have to do it with other people's inputs, so you're using other people's ability... at first it got us kind of gelling together and then we just naturally did it afterwards.

- Sally: I think it's a lot more open to ask questions...
- Beth: Yeah, I think it definitely encouraged me to keep going with problems when I've been stuck... when you're in a group and you see that other people have understood it, you know that it is possible and it just pushes you to keep going that bit further.
- Julia: She asks us to convince each other what the right answer is... she rarely actually gives us answers. You know, we have to work to the answers between us until we're all happy that we have got the answer...
- Dora: I feel it almost takes away that kind of elitist side of maths where somebody'll be like 'I have the answer. You don't have the answer', because it doesn't particularly work like that because we've all been discussing. Nobody really knows who's got what, but we've all gained.

Working together and supporting each other is expressed through *an ethic of caring* (Collins, 2000) where the experience of being left behind is turned around to be an opportunity to demonstrate solidarity with each other.

- Sue: I think maybe if everyone on the table understands it and... [you're the one] left behind... I'm not always the one [*laughter and cross talking*]... times like that it's not fantastic, but it's very rare that actually happens anyway because everyone tends to help everyone in our group.
- Sally: ... there's always somebody in the group... they'll go through it again and again if need be and I've been in the situation where I've understood something and somebody else hasn't and they've been getting a bit stressed out and I've been able to explain to them, like taking it back a step and going through things.
- Rach: Yeah, people are very good at giving you the time if they can see something's bothering you... helping you through... getting everybody to the same level before everyone moves on.

Conclusion

In order for hegemony to be questioned, students have to be able to gain a critical and reflective distance from the taken-for-granted. This cannot be accomplished without theoretical engagement with the workings of power and our own complicity in perpetuating and reproducing hegemonic discursive practices (Nolan, 2012). Here, however, I have foregrounded the significance also of *experience* in shaping our understanding of what it is possible to be and to do, of who we are and who we might become and of how we might act in and on the world. This springs from a conviction that inhabiting "potentiary" (Holland et al., 1998, p. 250) imaginative spaces defies the corruption of the capacity for hope that neo-liberalism engenders (Berger, 2007).

The interview data suggest that the students distanced themselves from neo-liberal discourses and experimented with other ways of constructing themselves and others, enacting new selves-in-

practice, engaged, confident, authoritative, agentic and participatory selves, selves which allow for a commitment to social justice. Mathematics is *par excellence* the discipline that is used to separate learners from each other, to valorise individuals, to rank them and to place them in hierarchies in order to justify fundamental inequalities as appropriate and merited. In addition, it epitomises a separated, de-personalised, moral-free epistemology. Combatting these ways of using and understanding mathematics with the experience of solidarity – challenging ‘ability’ hierarchies, experiencing pleasure and caring within a learning community and developing agency and both personal and shared epistemological authority – has the potential to support the fight for social justice in mathematics education.

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