Modelling and social justice in secondary mathematics teaching: Political narratives and teachers' beliefs

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In this paper I look at the idea of modelling in secondary mathematics lessons in England, from a position of social justice. I claim that modelling is inconsistent with social justice as it leads to a lack of agency and mathematical power. I gather data from six teaching staff through drawings and interviews to try and understand why modelling is prevalent despite these problems. The findings suggest that some participants align closely with a modelling approach, and that the narrative around modelling is part of a wider narrative of control and conformity that is linked to the neoliberal political landscape.

Keywords: modelling; transmission; social justice; mastery mathematics

Introduction

Mathematical understanding can empower students to actively contribute within society. This means that mathematics education can be a powerful tool for social justice, breaking down structural barriers to participation. I am concerned about the rise in 'modelling' approaches, where the teacher demonstrates a technique one step at a time, before students attempt to replicate it using the same steps. Modelling is inconsistent with a social justice approach and this paper aims to try and understand its prevalence despite its problems.

Literature Review

Modelling is a form of transmission teaching as the teacher transmits knowledge to the student, and the student receives the knowledge (e.g. Dewey, 1938; Freire, 2000). Modelling is often associated with a 'mastery mathematics' approach which is now widespread in schools and commercial educational products (Boylan, 2018). Mastery mathematics is not well defined but generally involves breaking down mathematical content into small steps which must be mastered one at a time before students move on to the next step (e.g. Education Endowment Foundation, 2021). These individual steps can be demonstrated by teachers through modelling.

Freire (2000) critiques the transmission approach, saying that it creates students who are passive receivers of knowledge. As a result, students lack agency and mathematical power (Nolan, 2009) and do not have the opportunity to challenge injustices within the system (Povey, 2002). These criticisms are a fundamental part of my study, as they mean that modelling is inconsistent with a social justice approach.

Several factors may have led to the current prevalence of modelling. Neoliberal policies within education allow parents to view league tables of exam results and choose schools for their children, creating a competing school market (Ball, 1990). As exam results take priority, teaching to the test becomes common (Reay, 2017) and modelling can be used to prepare students to regurgitate specific techniques that are likely to come up on the test. It is easy for a pedagogy (like modelling) to become established and reproduced as teachers continue to teach as they learnt (e.g. Wright, 2017). Modelling can also produce short-term gains within lessons or blocks of lessons (e.g. Skemp, 1976), allowing teachers to move onto the next step in a mastery curriculum and meet the pressures imposed by school leaders. These short-term gains are usually linked to a surface-level understanding (Skemp, 1976), further reducing mathematical agency and power. These dominant narratives create an opportunity for doxa (Bourdieu, 1972/1977). Doxa is the internalised and unquestioned acceptance of a set of ideas, practices or values, such as students working hard, or schools following a curriculum based on knowledge.

Based on the literature, I have two research questions: Firstly, in what ways do teaching staff align themselves with a modelling approach? Secondly, in what ways is this internalised, unquestioned or part of a wider narrative?

Methodology and ethics

I worked with five teachers and one teaching assistant (TA) that I knew through my teaching connections. I asked each participant to draw a picture of themselves as a teacher/TA to see what they initially prioritised. I then asked them to tell me about their picture, before asking them some more general questions about their beliefs and experiences of maths education, such as "Is there anything that you do in the classroom which is different from what other people do?" The names of participants, schools and commercial education packages have all been replaced by pseudonyms.

Findings

Alignment with a modelling approach

Out of the five teachers, Sally, Gareth and Debbie were closely aligned with a modelling approach, Leanne was fighting against a modelling approach, and Sue was conflicted. All five of the teachers drew and/or described themselves as being at the front of the room. Even Leanne who fights against a modelling approach still describes herself as "standing at the front of the class". Sue draws a stick figure and says "That's me, probably at the front of the classroom, purveying some form of information." At this early point in the interview, Sue already appears to feel pressurised to teach in particular ways, as she says "That's what we're sort of encouraged to do. So, always be standing."

Sally, Gareth and Debbie describe using modelling techniques. Sally's drawing is based around modelling:



She says "I trained at Sixsmith Academy, so classic [laughs] – classic teaching – this is how you do the, explanation, this is how you do it, give the students something similar to do for themselves – that's their worked example." She expresses a belief that this technique is widespread: "I imagine most teachers will do some kind of worked-through example of everything they're doing on the board, and there will be children doing practice questions on that topic."

Sue, although conflicted, also describes a modelling approach, saying "I suppose they're all trying to emulate in some way what you've done to get an answer to something." Gareth describes students moving through a set of objectives, saying "we get it done. We don't need to fluff around the edges of it." Tanya (TA) echoes this idea, saying "I should be being observant about who's in the classroom, and who's actually getting it and who's not getting it."

Internalisation

Sally, Gareth and Debbie all explicitly state their agreement with a modelling approach. Gareth says "I think maths teaching does lend itself to good modelling." This quote from Sally brings up ideas of student deficiency and the teacher attempting to control learning, as she explains why she thinks modelling works best:

Particularly with kids nowadays, they're very – their attention span isn't amazing, and it allows like, to break things down into chunks, so it gives the lesson lots of different phases. It allows me to quickly see who's got things and who hasn't.

Debbie talks about a commercial education package called *Numberline* that her school uses, which includes an ordered scheme of work and resources:

Lots of schools all over the country have adopted *Numberline*. It's not perfect, but as a scheme of work, it's a much stronger starting point to enable us to have better resources. ... It embeds mastery ideas, but then we build on it. So I would say there's two phases of what schools look like in England. There'll be ones who have adopted mastery and use imagery, and you'll see similarities between schools and there's the ones who are kind of slightly behind, who might be using something else.

Debbie associates mastery approaches with moving forwards towards an objectively better approach to teaching, linking to neoliberal ideas of competition. She also values the *Numberline* package because it gives her access to resources which she didn't have before: in this way, commercial education companies are helping to drive the narrative towards mastery approaches. Private companies – driven by profit – are influencing public services and amplifying the neoliberal narrative, further embedding neoliberalism within education.

There were several examples of participants referring to modelling as an unquestioned truth. Gareth spoke about "best practice" and had to be prompted to explain that this meant "asking questions, modelling, that kind of thing". Even Leanne, who does not align herself with modelling, started to say that in every classroom, there would be examples, explanations and questions, before reflecting and changing her mind. Sue uses the phrase "the way it's taught" to refer to the choice of technique that is modelled. Participants also used vocabulary associated with transmission and mastery learning, such as 'intelligent practice', 'I do, you do' and 'embedded' (Debbie), and 'your turn' (Sally). These terms were used naturally in sentences with the assumption that we all understood and accepted their meanings, suggesting that they were part of a dominant narrative. This narrative is also dominant amongst students. Leanne has found that her students resist her style of teaching as it is not what they are used to, for example:

But she's like: 'Oh just give me the information miss! You just keep saying go and investigate! Just give me the information!' So I'm kind of challenging her to think but she doesn't like it, so she gets quite arsey with me.

Tanya (TA) says:

I think what they learn in maths, is right. You know, when we come to like, you know, you know, your radiuses and circumference, you know, you're icing a cake and you've got your layers and do you know what I mean, you know, you, you've got a really great cake recipe, but you wanna make a massive one for someone's birthday, you know, I know it sounds stupid, you know, planting a garden and, and zoning it out.

This is an interesting quote because Tanya states her agreement with the approaches to teaching that she sees in classrooms (which are based on modelling) but actually describes a different kind of approach to teaching, based on real-life problems and practical applications. It appears that Tanya has accepted the dominant narrative unquestioningly, to the point where she cannot recognise an alternative way of teaching even though she appears to believe in one.

This narrative manifests itself in school structures and pressure from school leaders. Leanne describes her experience of these pressures:

"It's really moving to direct instruction. You know at school, we've got this whole 'I do, you do,' no, 'I do, we do, you do' silent-teacher model. And I mean, I've done it, and I always kind of do it with a silly face and you know, lots of gesticulation, which I don't think you're meant to do, but, I kind of try and comply and you know, I can't think, what's the word? Comply in a non-compliant way?"

She listens out for senior management: "you can hear their clippy cloppy shoes, so you make sure you're doing it." She describes colleagues who have not complied, saying "people have been managed out of their jobs."

Sue describes feeling unable to teach in the ways she wants: "I used to love it when you could do like treasure hunts and things like that, which now seems to have gone as to be a big no-no." As the interview goes on, she expresses more frustration with modelling approaches, and some resignation:

Sue: "You've just got to sit there and teach 'em. Okay, so. That's just how I feel. And I think the pedagogy side of it, there's more of like, you need to model the answer, they do this, they do that, then you model another" ...

Me: And how does that make you feel?

Sue: [sighs] Sometimes frustrated, I suppose other ways I feel like, oh, well, they must know better than I know. But I'm sure it'll go round again in a circle. ... I don't know why we don't take the best of everything, instead of no, this is how we do it now. I just think it's much more restrictive now than what it used to be.

Leanne and Sue experience a lack of teacher agency. Gareth and Debbie, Related to this is the use of modelling to gain control in the classroom. Gareth says "I like being in control and I like controlling the class." Debbie uses the language "tame them" and says "I think the children know where they stand." This creates a culture of control and conformity that is bigger than modelling. Sally and Leanne both describe a regimented, Pavlovian classroom – Sally describes it positively but Leanne describes it with despair:

Sally: It's a strategy the kids know and they can predict what's going to happen. So, for example, I lost my voice for an entire week last term and the kids did

everything on autopilot. They knew exactly what was coming, they knew what there was going to come up on the board, they were like, right, here comes the worked example, here comes my 'my turn', I get my book out, I know what's coming. Right, I bet there's going to be some diagnostic questions now, so she's not even going to say it, I'm going to reach for my whiteboard and I'm just going to do it. So it like, trains them as well. So you've got like a kind of scheme of what they're going to predict, they're trained into what they know and then they feel more confident and more comfortable with it.

Leanne: My overwhelming emotion is utter, utter sadness. ... I don't want to have a generation of non-thinking people. There's like, there's a movie, I think it's called 'Metropolis'. ... and it's all these kind of people walking like little automatons and, you know, hitting, like this. And I just feel that that's, that's what I'm constantly reminded of, that *horrible* movie, and we're producing automatons for the future. And even, again my school's kind of jumped on the bandwagon of the Doug Lemov 'Teach Like a Champion' [a book], so all the children have to 'SLANT'*. And again, somebody, one of the, one of the [senior leadership team] members said 'Oh, you know, they're like Pavlov's Dogs when you say slant'. And I just thought, I don't think that's something we should celebrate. You know, I don't think that's a good thing, I think you should be ashamed of yourself.

*SLANT is an acronym which stands for sit up - listen - ask and answer questions - nod your head - track the speaker

Sue criticises the conformity that is required with a modelling approach, saying "We try to *fit* too many square pegs into round holes, and it *doesn't* work." There is a very emotional moment in the interview with Tanya (TA), where she becomes upset when talking about how students often "can't be bothered" and don't realise "how good it could be." She appears to relate her own struggles with education to the struggles of the students, and begins to cry, saying "How must little Flora feel when she cries because she can't do it?" Tanya suggests that the conformity required for students to succeed is just not possible for some students, because it is incompatible with either their wider home lives or their accessibility needs.

Discussion

The teachers expressed a separation between themselves and the students, signalled by their position at the front of the room. This fits with the separation of teacher as transmitter of knowledge and student as receiver (e.g. Freire, 2000), as well as linking with wider narratives of control. Alignment with modelling was seen when teachers described themselves as demonstrating or giving a worked example, and students attempting to copy the method or complete a 'your turn' question. Gareth also talked about getting the work done, suggesting that learning is about moving through a sequence of activities one at a time. Once the teacher has modelled the technique, the class can move on to the next objective. This creates a mathematics education which is narrow and predetermined, lacking in student agency.

What came out clearly in the findings was the fact that this modelling approach is everywhere in education. Within an educational setting, teachers, students and school leaders can use the ideas and language of modelling and it will be understood. There is a strong narrative around modelling and the associated ideas of control and conformity, which is maintained by government policy and exam pressure, commercial education companies and school leaders. In some cases the narrative becomes an instruction as teachers are directed to use modelling techniques. It is unsurprising therefore that Sally, Gareth and Debbie appeared to align closely with the modelling approach to teaching. For Leanne and Sue, these pressures have resulted in a lack of teacher agency, so that both students and teachers lack agency. Leanne disagreed not just with classroom techniques, but with the wider narrative, expressing her despair at the way students were being turned into 'automatons'. Sue experienced internal conflict, trusting that the dominant approach must be the right one, whilst also expressing conscious or subconscious doubts. Sue and Tanya (TA) both expressed concern about conformity, as students were funnelled into a narrow way of knowing, doing and succeeding.

Conclusion

The prevalence of modelling is part of something much bigger than the classroom: it reflects a narrative of conformity and control within education and wider society. This narrative is dominant amongst teachers, students, school leaders and commercial education companies, so that ideas of modelling become part of the everyday talk in schools. Some of my participants aligned themselves with this approach, seeing a separation between themselves as transmitters of knowledge and students as receivers. There were also examples of fighting against this approach or experiencing internal conflict between the dominant narrative and their own opinions. Challenging the modelling approach will not only be a battle against the status quo – as Leanne experienced – but also an internal battle as we have to identify and sort through our own complicated beliefs and opinions and overcome the doxa we all hold.

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