

The critical role of teacher educators in promoting socially just mathematics teaching

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Abstract

This paper focuses on the enablers and constraints that shape mathematics teacher educators' agency in addressing social justice issues within their practice and how these can be harnessed or overcome. Given the potential impact of teacher educators on the student/practising teachers they work with, and consequently on the agency of classroom teachers in teaching for social justice, this is an important area that warrants further research. We adopted a participatory action research methodology in establishing a team of 15 'teacher educators' (broadly defined) working in universities and other settings across England and Scotland. We drew on a theoretical framework based on critical pedagogy and critical mathematics education. Research team meetings focused on designing and evaluating teaching strategies and professional development workshops, which were tried out with student teachers and practising teachers. Data were collected from group discussions in which teacher educators reflected on constraints and opportunities within their own practice. The findings showed that key constraints faced by teacher educators include the dominant discourses and narratives encountered by teachers of mathematics they work with, often generating conflict between aspirations to adopt critical pedagogies and pressures to align themselves with prescriptive and disempowering pedagogies common in schools. Enablers included the collaborative and supportive nature of the research team, which provided teacher

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educators with space and time to interrogate their own practice, to raise their critical consciousness and to develop confidence to advocate for, and promote, socially just teaching approaches.

KEYWORDS

agency, critical pedagogy, mathematics teacher educators, social justice

Key insights

What is the main issue that the paper addresses?

An alternative vision of education for the public good, based on critical and transformative pedagogies, has become more important than ever. This paper explores the enablers and constraints that shape teacher educators' agency in promoting socially just mathematics teaching amongst student teachers and practising teachers they work with.

What are the main insights that the paper provides?

Teacher educators have a vital role to play in prompting classroom teachers to question prior assumptions about teaching and learning mathematics and enacting critical pedagogies. This paper demonstrates how a collaborative support network, organised around critical and participatory principles, can enhance teacher educators' agency in promoting socially just mathematics teaching.

INTRODUCTION

Critical pedagogies are inherently transformative modes of education that focus on changing society for the better, in contrast to more conservative pedagogies, endorsed by neo-liberal policies, that aim to reproduce society in its current form (Giroux, 2020). They have become more popular as a way of empowering learners and developing the agency, both individual and collective, that is increasingly recognised as necessary for tackling crises facing global society. There is a growing research literature generating useful insight into how schoolteachers might employ these pedagogies, both within formal schooling and in less formal learning environments (Xenofontos et al., 2020). Much of the literature focuses on the Freirean notion of the teacher as 'educator', which involves the teacher engaging students in dialogue and reflection, leading to greater awareness of their own position in the world and enhanced agency (Freire, 1974; Giroux, 2020). This is in contrast to dominant discourses in schools (particularly in England) around teacher-led 'instruction' in which the teacher is seen as an authoritarian figure with the primary responsibility for providing knowledge to students (Wright et al., 2022), resulting in a culture of student dependency reminiscent of Freire's (1972) 'banking' concept of education.

Relatively little attention has been paid to the role of teacher educators (those involved in the professional learning of teachers) as 'educators' (in the Freirean sense). Given the

potential impact of teacher educators on the agency of teachers, and consequently on the agency of students, this is an important area that warrants further research. This paper reports on the findings from the Promoting Socially Just Mathematics Teaching (PSJMT) research project, which asked: How can mathematics teacher educators' agency in addressing social justice issues within the teacher education programmes they provide for student teachers¹ and practising teachers be enhanced? Within this broader question, this paper aims to shed light on the enablers and constraints that shape teacher educators' agency and strategies that can be employed to help harness and overcome these. The project adopted a participatory action research (PAR) methodology (Skovsmose & Borba, 2004; Wright, 2022) by establishing a research team of teacher educators, providing a space for them to meet, collaborate and reflect, and analysing the resulting discussions. It was supported by a grant from the BERA Small Grant Fund. The next section outlines the theoretical rationale behind the research project.

CRITICAL PEDAGOGY, MATHEMATICS AND TEACHER EDUCATORS

Despite increasing access to information via the Internet, making the impact of widespread conflict and global warming on marginalised communities more visible (Coles et al., 2024), people in Western democracies continue to tolerate governments that prioritise exploitation of the world's resources for profit and militarism over sustainability and peace. Giroux (2022) warns of the recent rise in anti-democratic populism, with news media and social media used by those in power to spread fear, cultivate hate and undermine humanistic values. He outlines how the COVID-19 pandemic (2020–2023) has made educational institutions increasingly vulnerable and accelerated their rising dependence on commercially motivated decisions to survive. Within an environment dominated by neo-liberalism, he highlights how education has become a tool for promoting global capital, with the complicity of teachers who implement a pre-determined curriculum rather than exercising their professional judgement. Drawing on Dewey's (1916) ideas, he argues that democracy depends upon knowledgeable citizens with critical understanding that enables them to hold those in positions of power to account. Therefore, an alternative vision of education for the public good, based on critical and transformative pedagogies, has become more important than ever. Reviewing the role of teachers and teacher educators in enacting these pedagogies is key in formulating such a vision.

Freire's (1974) 'education for critical consciousness' calls for a radical shift in pedagogical relationships, with educators entering into dialogue with learners and posing questions that prompt them to debate and reflect on contemporary issues, contrasting with conventional teaching approaches based on transmitting knowledge and imposing solutions. Freire highlights how education becomes empowering when it enables learners to develop greater awareness of their own situation and their place within society, prompting them to ask questions and take actions leading to increased individual and collective agency. This radical shift applies both to pedagogical relationships between teachers and students, and to those between teacher educators and teachers.

Freire's (1998) 'pedagogy of hope' poses questions about what it means to learn, know and understand in relation to issues of power and oppression. Giroux builds on Freire's ideas in calling for a 'pedagogy of resistance' (Giroux, 2022) that connects learners' personal experiences to struggles for justice and freedom, helping them to develop the skills, knowledge and capacities they need to take actions for the public good. Biesta's (2022) 'world-centred education', which involves educators directing the attention of learners towards the world in which they live, also draws on Freire's ideas. This, Biesta argues, is vital for helping

future generations to make sense of the world and how they relate to it, preparing them to tackle challenges facing society. Biesta's argument reinforces calls from international policy-making organisations (OECD, 2018; OECD, 2024a; UNESCO, 2015) for a school curriculum that enables students to develop the skills, knowledge, critical understanding and collective agency needed to tackle social, economic and environmental crises facing global society.

Reviewing the place of mathematics is particularly important when it comes to considering what an empowering school curriculum might look like (OECD, 2024b). On the one hand, school mathematics plays a central role in reproducing existing power relations from one generation to the next. The strong association between socio-economic background and mathematical attainment persists in many countries, with school mathematics acting as a 'critical filter' that determines students' access to higher-status university courses and better-paid jobs (Jorgensen, 2016). Many mathematics students, particularly those from less privileged backgrounds, experience prescriptive teacher-led pedagogies, involving the modelling of a solution to a closed problem followed by practising a series of almost identical exercises, which lead to alienation, a growing fear of mathematics, disengagement and disempowerment for many (OECD, 2024b; Skovsmose, 2011; Williams & Choudry, 2016).

On the other hand, mathematics can be used by learners as a powerful tool for understanding contemporary issues and to support an argument for social change (Wright et al., 2024). Skovsmose (2024) outlines how mathematical models can be used to highlight inequalities within society and to publicise the extent of climate change. He calls for a 'critical mathematics education', drawing on Freire's (1974) 'critical pedagogy', that involves learners carrying out meaningful mathematics inquiries that help them to better understand their own social, economic and environmental situations. This approach encourages learners to pose their own problems, choose their own approaches, interact and communicate with others and to question the nature and use of mathematics in making decisions (Skovsmose, 2011).

There are examples of research demonstrating how teachers can operationalise such critical pedagogies within their mathematics classrooms (Gutstein, 2016; Wright, 2017). However, the constraints on teachers of mathematics are considerable, including pressure to cover content to prepare for high-stakes tests, lack of time for planning and sharing practice, and prescriptive schemes of work (Wright, 2017). School mathematics is riddled with myths and discourses, such as that mathematics is value-free and always either right or wrong (Coles & Sinclair, 2022), and that mathematical ability is fixed (Boaler, 2022). These discourses contribute towards the predominance of transmission-based teacher-centred pedagogies (Williams & Choudry, 2016). Teachers need to recognise and challenge these discourses through engaging with professional learning that prompts them to interrogate their own beliefs and assumptions about teaching and learning mathematics, to develop a clearer understanding of the constraints they face and how to overcome these (Wright, 2022). Teacher educators have a vital role to play in providing such professional learning opportunities.

Unfortunately, much professional learning provided to teachers either ignores the importance of agency altogether (Boylan et al., 2018) or focuses too much on individual agency whilst neglecting the environment in which teachers operate (Biesta & Tedder, 2007). Priestley et al.'s (2015) 'ecological' approach highlights the importance of acknowledging specific conditions that enable or constrain teacher agency. Agency is conceptualised as having an 'emergent' property, in other words, it arises from complex interactions between people, material conditions and society (Cathcart et al., 2026). This helps to explain why agency can be achieved in one context but not in another and why engaging critically with the dominant discourses in mathematics education (described above) is crucial when considering teachers' agency in enacting critical pedagogies in mathematics classrooms.

Ecological approaches to teacher agency resonate with literature highlighting the benefits of 'communities of inquiry' (Jaworski, 2006) and 'critical collaborative professional enquiry'

(Priestley & Drew, 2019). In such communities, teachers come together to 'interrupt' habitual thinking and reflect on practice through critical questioning and engagement with research literature. Emphasis is placed on how the development of critical understanding is facilitated by an external agent, such as a researcher or teacher educator, who can draw on their theoretical knowledge to challenge teachers' beliefs and assumptions. Teachers within these communities are supported in exercising 'critical reflexivity', which can be broadly understood as questioning assumptions, recognising and acting upon subjective investments and interrogating how power, ideology and contextual factors shape pedagogical practice (Giroux, 2022). This is of particular importance in the field of mathematics education, in which different ideological groups exhibit fundamentally conflicting views about the aims of mathematics education (Ernest, 2014).

Cochran-Smith et al. (2009) highlight the growing number of initial teacher education (ITE) programmes that emphasise social justice, which they define as 'enhancing students' learning and their life chances by challenging the inequities of school and society' (p.350). They outline how the student teachers they worked with were successful in developing practice that provided rich learning opportunities for all students, although the changes tended to focus on their own classrooms and broader structures were left unchallenged. Grudnoffa et al. (2017) highlight the need to locate practice for equity within political and social contexts. They emphasise the importance of teachers being critically reflexive and collaborating with others, and the need to consider teachers' beliefs and values, knowledge and interpretive frames, efficacy and agency. Mockler (2013) emphasises the growing need for professional learning to foster teacher autonomy and risk-taking, within an educational policy climate increasingly characterised by compliance and accountability. Again, this underlines the growing importance of teacher educators in facilitating collaboration between teachers and encouraging teachers to engage in critical reflection.

Addressing social justice issues within teacher education programmes includes encouraging teachers to enact socially just teaching approaches within their own classrooms (informed by some of the literature outlined above), but it should go beyond this. We argue that teacher educators have a vital role to play in promoting critical reflexivity among teachers and hence cultivating pedagogies that are truly critical and transformative. However, there is little guidance available for teacher educators on how they might go about doing this, particularly in the field of mathematics education. Indeed, in England in particular, teacher educators have recently faced a series of policy reforms designed to erode their autonomy. These include the introduction of the Core Content Framework (CCF) in 2019, subsequently incorporated into the Initial Teacher Training and Early Career Framework (ITTECF) in 2024, which specified detailed content requirements for ITE courses, which had previously been left to teacher educators to decide (DfE, 2024). This was accompanied by a reaccreditation process (which began in 2022) that ensured universities complied with the reforms.

The 'official' professional development provided to mathematics teacher educators is often quite prescriptive in nature, for example, the Maths Hubs in England (funded by the UK government) provide bespoke training for teacher educators that aims to explain the principles of teaching for 'mastery', promoted by the National Centre for Excellence in the Teaching of Mathematics as the 'five big ideas' (NCETM, 2017), and how to equip teachers to deliver lessons that adhere to these principles. Where possible, the Maths Hubs provide training directly to teachers in schools (particularly in primary schools) via their own group of 'development leads', specifically chosen and identified for this purpose, thus bypassing university-based teacher educators altogether. Gabi et al. (2023) highlight how teacher educators in England, with a desire to develop decolonial and anti-racist practice, are left to work it out for themselves in the absence of any guidance from the official ITE curriculum (DfE, 2024).

Whilst some research has focused on the agency of teachers, the agency of teacher educators remains a relatively under-explored area. Similarly, there has been little research carried out into the development of mathematics teacher educators' practice and expertise in general (Helliwell et al., 2026). The PSJMT research project outlined below set out to address this gap in knowledge by exploring how adopting an ecological approach and establishing their own communities of inquiry can help mathematics teacher educators develop agency in promoting socially just pedagogies across the different education contexts they work within.

METHODOLOGY

The PSJMT research project employed a critical model of PAR (Skovsmose & Borba, 2004), a participatory methodology in which practitioners are involved in key decisions relating to the development of the research design, actions to be tried out to address the research aims, and the collection of data to evaluate the outcomes. The model is 'critical' in the sense that it is based on the premise that current practice should not be taken as given. Through recognising and drawing on practitioners' unrivalled knowledge of their own professional contexts and taking into account the practical constraints they face, this model has been shown to generate more trustworthy findings than conventional research with greater relevance to other practitioners and contexts (Wright, 2022). The project's research design also drew on the principles of 'critical collaborative professional enquiry' (Priestley & Drew, 2019) and 'communities of inquiry' (Jaworski, 2006) described earlier.

A research team was established with members recruited from the Teaching Maths for Social Justice Network (TMSJN), a group of teachers, teacher educators and researchers spanning all phases of mathematics education, by the first author (who was also the TMSJN convenor). Hence, the 15 members of the research team shared a prior commitment towards promoting socially just mathematics teaching. Twelve members of the research team worked (or had recently worked) on ITE courses across different universities, geographically spread across London, the South-East, Midlands and North of England, and Scotland. Some worked mainly within primary education, others within secondary education and others across both phases. Among these 12, there was a significant spread of experience from those with several decades spent in teacher education to others who had only recently taken on that role. The other three members of the research team had broader connections to teacher education, such as working for an educational organisation or as a teacher or researcher with an interest in teacher education. Six members of the research team were also completing their own doctoral research studies in a related field.

Henceforth in this paper, 'teacher educators' is used to refer to all 15 members of the research team, which included all nine co-authors of this paper. It is worth noting that the invitation to participate in the project that was circulated to all members of the network (approximately 250) made it clear that participation was open to anyone who identified as a 'teacher educator' and that those carrying out their doctoral studies were particularly welcome (this was related to a condition of the funding). All those wishing to take part were able to do so. The research adhered to ethical principles relating to informed consent and confidentiality of data and was carried out with the approval of the University of Dundee Research Ethics Committee.

The research team agreed unanimously at the start of the project to adopt the following conceptual framework, proposed by the first author, which identifies four essential elements for teaching mathematics for social justice (TMSJ):

- 'Employ collaborative, discursive, problem-solving and problem-posing pedagogies which promote mathematical sense-making and the engagement of all learners with mathematics.
- Promote mathematical inquiries that resonate with learners' real-life experiences and that help them develop a greater understanding of their social, cultural, political and economic situations.
- Facilitate mathematical investigations that develop learners' individual and collective agency, enabling them to take part in future social action for the public good.
- Challenge common myths surrounding school mathematics, expose processes that lead to the marginalisation of some learners, and open up to scrutiny what it means to be successful.' (Wright, 2024, p. 26)

The framework draws on Freire's (1974) 'critical pedagogy', in advocating for dialogic problem-posing pedagogies (element 1) which enhance learners' critical consciousness (element 2), and on Skovsmose's (2011) 'critical mathematics education', in calling for investigative approaches that develop learners' agency (element 3) and for reflection by learners on the nature and position of mathematics (element 4). The framework has been refined over time following various collaborative research projects previously conducted by the first author with teacher researchers in schools (Wright, 2024).

The research design incorporated a series of three research team meetings held between November 2024 and May 2025. These meetings were used to share teacher educators' experiences of promoting TMSJ and to plan and evaluate actions to be taken between meetings. These included individual actions taken as teacher educators working with both student teachers and practising teachers, and the joint planning, trialling and evaluation of a series of professional development workshops aimed at supporting teachers in developing socially just teaching practice. These workshops were subsequently made freely available on the network's website (www.mathsocialjustice.org/prof-dev). Whilst these meetings were organised and facilitated by the first author, their deliberately non-hierarchical nature allowed educators to learn from each other and to probe and question each other's prior assumptions and beliefs. The research team thus provided a supportive and constructive environment in which teacher educators were able to exercise critical reflexivity as part of a community of inquiry (Jaworski, 2006; Priestley & Drew, 2019).

The data that we present in this paper were collected during reflective group discussions held during the first and third research team meetings, which were face-to-face whole-day meetings held near the beginning and end of the project. In meeting 1, teacher educators were invited to share their previous experiences, in particular the constraints and opportunities they encountered in promoting TMSJ. Nine of the 15 teacher educators did this in person at the meeting, with the remaining six doing so at a short online catchup meeting. In meeting 3, the 11 teacher educators who were present were invited to reflect on the impact the project had on their thinking and practice. In both meetings, teacher educators were encouraged to comment on and respond to each other's contributions. Note that meeting 2 was held online at the midway point of the project and focused on the design of the professional development workshops. No data were collected from this meeting. Further data were collected through conducting interviews with teachers who participated in the trialling of the professional development workshops. The findings from the analyses of these data are reported elsewhere.

Initial data analysis of the research team meetings was conducted by the first author. Audio recordings of these meetings were transcribed using a literary style (ignoring pauses, intonations, fillers, colloquialisms) so that the teacher educator's collective experiences could be narrated as a readable story (Kvale & Brinkmann, 2009). Thematic analyses were

then conducted on these transcripts using Braun and Clarke's (2022) six phases: familiarisation with the data; generating codes inductively; applying the codes to the transcripts (employing NVivo software); searching for themes and subthemes; reviewing and naming themes; and reporting themes. The codes used in the thematic analysis relate closely to the paper's focus on exploring enablers and constraints that shape teacher educators' agency and are presented in Table 1. Draft transcripts and initial findings of the thematic analyses were presented back to the rest of the research team to check for accuracy and authenticity.

FINDINGS

In this section, we report on the findings of the research project that relate to the enablers and constraints that shape teachers' agency in enacting, and teacher educators' agency in promoting, socially just mathematics teaching. Three overarching themes emerged from the analysis of the transcripts of reflective discussions held during research team meetings: insights into mathematics teaching in schools (drawing on data from meeting 1); insights into mathematics teacher education (drawing on data from meeting 1); and the impact of the project on teacher educators (drawing on data from meeting 3). These were underpinned by eight sub-themes, which are reported below. Selected quotes from teacher educators (attributed using pseudonyms of their choice) are included to exemplify the findings from the thematic analysis.

Theme 1: Insights into mathematics teaching in schools

Subtheme 1.1: Environment and constraints within school mathematics

Teacher educators reported a growing number of constraints, related to increasingly neoliberal policies, that have made TMSJ more difficult for the teachers they work with in schools:

My feeling, since I started this job about 11 years ago, is that there has been a real reduction in people's confidence to teach in the ways that were encapsulated in that socially just maths definition.

(Alex)

They described how dominant discourses and narratives they encountered in schools often ran counter to the principles of TMSJ:

In schools, and in teacher education, there is an attempt to really straight-jacket practitioners, and indeed learners too ... they have to have their PowerPoint submitted for approval ... which no teacher should ever be subject to.

(Robin)

One discourse that was seen as constraining the promotion of TMSJ was the increasing importance attached by teachers to tests, exams and qualifications:

One of the constraints is the way that the purpose of learning mathematics has become narrower ... focused on assessment ... so that getting kids through exams has become seen as achieving social justice. It's closing the gap ... that's a misunderstanding of what maths for social justice is.

(Anna)

TABLE 1 Inductive coding used in thematic analysis of reflective discussions.

Codes	Elaboration
<i>(1) Broader perspectives</i>	
(A) Commitment to TMSJ	Teachers generally demonstrate high levels of commitment to TMSJ
(B) Putting TMSJ into practice	Teachers face difficulties/constraints in putting TMSJ ideas into practice
(C) Decline in TMSJ over time	Decline in teachers' confidence to implement TMSJ over time
(D) Views of maths	Views of maths/views of maths education/purpose of maths/philosophies
(E) Importance of ITE	View of ITE as important for planting seeds/impacting practice
<i>(2) Role of teacher educators</i>	
(A) Personal reflection	Teacher educators reflecting on their own ITE experiences/contrasting systems
(B) Modelling TMSJ	Teacher educators' desires to model SJ approaches in their own teaching
(C) Frustration	Teacher educators' personal frustration and feelings of swimming against the tide
(D) Evaluating inputs	Opportunity to listen to teachers' voices and collect feedback
<i>(3) Constraints on teacher educators</i>	
(A) ITE curriculum (constraints)	Limited time within the ITE curriculum (England) Interference from policymakers in ITE curriculum – accreditation (England)
(B) Professional development	Professional development is increasingly provided by Maths Hubs (Mastery agenda)
<i>(4) Opportunities for teacher educators</i>	
(A) ITE curriculum (opportunities)	Relative freedom to plan ITE curriculum Incorporating TMSJ/problem solving into ITE assignments and modules
(B) Policy themes	Educational policy themes – sustainability (Scotland); SMSC (England) Needs of other stakeholders, e.g. employers' needs to solve real-life problems
(C) Initiating TMSJ	Critical reflection important first step – questioning the status quo Problem solving useful way into TMSJ – incremental developments in practice
(D) Confidence and agency	Prepared to advocate for TMSJ and incorporate ideas into practice Support and encouragement provided by the research team
(E) Depth of understanding	Greater appreciation of TMSJ issues and associated pedagogies
<i>(5) Constraints on teachers</i>	
(A) Absence of TMSJ	Not experiencing other teachers implementing TMSJ/problem solving Lack of available resources on TMSJ
(B) Classroom culture	Traditional views/perspectives of maths teaching – discourses High-stakes testing and focus on closing the attainment gap
(C) Teacher confidence	Lack of subject knowledge/confidence in maths (primary)
(D) Schemes of work	Prescriptive schemes of work with little autonomy for teachers High levels of content leave limited curriculum space A knowledge-based curriculum makes it difficult to establish links with SJ issues
(E) Inequity in pedagogy	Deficit views of students as being dependent – lacking agency Less privileged students tend to experience the most prescriptive methods

(Continues)

TABLE 1 (Continued)

Codes	Elaboration
<i>(6) Opportunities for teachers</i>	
(A) Available support	Professional networks provide opportunities to share experiences/provide mutual support/overcome constraints/develop agency Support from senior management – meeting external requirements
(B) Available resources	Existing resources – inspiration – highlight connections between maths/social issues Using real-life stories as a way into TMSJ (primary)
(C) Observed benefits	Benefits of TMSJ: Increased student engagement, more meaningful experiences, more fulfilment/enjoyment as a teacher Recognising aims of TMSJ align with effective maths teaching and learning
(D) Lower-attaining groups	Lower-attaining groups can provide opportunities to try something different

One teacher educator based in a school referred to departmental policy that endorsed prescriptive teacher-led approaches as a significant constraint on enacting TMSJ:

Our department policy says to use 'I do, we do, you do' as much as possible in lessons ... they're expecting us to put an example on the board and demonstrate it. And then have a bit of a 'back and forth' with the students where they fill in gaps and things. And then they just do a load of practise questions.

(Ava)

Frequently encountered deficit views of students (particularly low-attaining, younger and disadvantaged students) as lacking agency and ability were also seen as discouraging the teachers they worked with from enacting TMSJ:

"No, they won't be able to do this. It's too hard." It's the same conversation again and again and again. The idea of how you give access to 'low-threshold, high-ceiling' tasks, how you scaffold children, without just feeding them all the information and then giving a problem at the end ... is really tricky.

(Alex)

Prescriptive schemes of work and (particularly in England) a knowledge-based curriculum were seen as a major constraint on promoting TMSJ, in terms of regulating both the content of lessons and the teaching resources readily available to teachers:

We're coming into an environment where there are schemes of work, there's a lesson every day that you can pick up and teach, but there wouldn't necessarily be a lesson every day around social justice. So, how do you modify some of those schemes?

(Millie)

Teacher educators described how professional development experienced by teachers in England, including that provided through the National Numeracy Strategy and Maths Hubs (funded by the UK government to promote the implementation of new policy initiatives), often served to reinforce prescriptive approaches:

My role within the Academy Trust has been whittled away, because everybody's getting their professional development from the Maths Hubs, which means ... they're teaching essentially a scheme of work and textbooks.

(Alex)

Subtheme 1.2: Teachers' aspirations and the realities of classroom practice

Teacher educators described how many practising and student teachers share an enthusiasm for TMSJ and respond positively to TMSJ inputs:

There's been a really overwhelmingly positive response. It's almost like student teachers can't get enough of this, and they want more.

(Paani)

This enthusiasm is sometimes related closely to teachers' own lived experiences:

The student [teacher] population on primary, I would say, is about 75% from global majority communities. ... I felt that they have much more of an engagement with this work, because they are also talking about their lived experiences.

(Millie)

However, teacher educators reported how, despite their enthusiasm for TMSJ, teachers of mathematics they worked with often found it difficult to enact in schools:

But then there are so many constraints and discourses and things that stop teachers actually putting them [TMSJ ideas] into practice. I'm always surprised by how many people do share that way of thinking, and yet it's not reflected in the practice in classrooms.

(Joe)

Constraints faced by these teachers in enacting TMSJ in classrooms often led to frustration:

My experience with teachers is ... how dispiriting it is ... if you are simply training children to perform in ... a very predictable exam.

(Anna)

Teacher educators described how student teachers often noticed a disconnect between ideas around TMSJ on the ITE course and practice they observed in schools, with early experiences in school placements having a significant impact on student teachers' thinking:

And one of the constraints, from student [teacher]s, ... they just couldn't see how those ideas would be enacted in practice.

(Skye)

They reported how this perceived disconnect sometimes led to frustrations among student teachers and a loss of enthusiasm for, or even resistance towards, TMSJ:

Even if I do something wonderful ... they might think: "Well, I will never use this in schools, so what's the point? Why can't you just tell me how to teach fractions?"

(Maya)

Teacher educators described how student teachers often experienced resistance to TMSJ ideas promoted on the ITE courses from teachers in schools:

We do things [on ITE courses] like responsive teaching, collaborative work, group work. But ... we've also had students told that "School doesn't believe in group work", so they can't do any group work.

(Caitlin)

However, teachers in schools sometimes appeared interested in finding out more about TMSJ:

The student [teacher]s got more confident about selling it [TMSJ] to their mentors. Because the mentors initially [asked]: “What do you mean, teaching maths for social justice? What does that mean?”

(Megan)

Theme 2: Insights into mathematics teacher education

Subtheme 2.1: Constraints within initial teacher education

Teacher educators reflected on how their own experience of ITE had a significant impact on their own thinking and practice around TMSJ:

... my own teacher education ... it certainly completely changed my whole understanding of what I thought maths was ... the purpose of teaching maths.

(Anna)

Others described how their own lived experiences had prompted them to become interested in TMSJ:

Why am I doing this? For me, it was also some lived experiences, being a person of colour. And seeing how maths could be used in a powerful way to address issues around race, around gender, around social class.

(Millie)

Others reflected on how educational experiences outside the UK had given them a broader perspective on TMSJ:

Questions came to my head immediately when I saw how things are done here. Because it's like: “We didn't do that where I come from”.

(Maya)

Teacher educators referred to specific policy reforms in England, including the introduction of the CCF, ITTECF and the DfE's reaccreditation process (referred to earlier), as placing additional curricular constraints on their practice:

There's very specific kind of things that we have to get through in an increasingly limited amount of time. So, I don't have the leeway to do it [TMSJ] in all the modules I teach.

(Maud)

They felt that the autonomy of teacher educators within universities, particularly in England, was being eroded over time with a growing sense of isolation:

The more years I spend in teacher education ... it just becomes a bit of a challenge, because sometimes you are that lone person driving this agenda forward.

(Millie)

Teacher educators described feeling unprepared to help teachers bring about broader changes in school beyond enacting TMSJ in their own classrooms:

Individual people ... agree with what we're saying ... going off and trying things ... I'm not sure how to help them make a change in terms of a whole school.
(Betty)

Subtheme 2.2: Opportunities within teacher education

There was a sense among teacher educators that their role provided them with an opportunity to influence future practice in relation to TMSJ:

The fact that this [project] is happening at all, and we're having these discussions ... is really quite powerful and exciting.
(Zuzana)

Despite the constraints they faced, they felt that their ITE programmes (in both England and Scotland) provided them with space and time to incorporate TMSJ ideas into the curriculum:

And I've used those four principles [TMSJ] to guide the work that we've done in that module ... that's been a great opportunity for me ... I can plan the time ... I can do what I want.
(Megan)

Whilst prescriptive schemes of work and knowledge-centred curricula were regarded as a constraint, teacher educators also highlighted elements of existing government policy aspirations that could be exploited as offering legitimacy to TMSJ. In Scotland, these include the promotion of Learning for Sustainability (LfS) and Interdisciplinary Learning (IDL):

Because I am in Scotland, in theory the curriculum would align really well with this [TMSJ].
(Maya)

My PhD is looking at global citizenship teaching in maths classrooms in Scotland ... in a space where it felt there were opportunities, because Scottish education policy was supporting this.
(Anna)

Teacher educators highlighted similar opportunities in England for exploiting policies that offer legitimacy to TMSJ, such as UK government policies to promote Spiritual, Moral, Social and Cultural (SMSC) aspects of learning and the promotion of mixed attainment grouping (as part of the 'teaching for mastery' agenda):

In England, you've got ... SMSC. ... there is quite a lot of opportunity within what teachers are expected to do.
(Joe)

From my tutees [student teachers], there seems to be more of a focus on mixed attainment, at least in the lower school years.
(Caitlin)

Teacher educators highlighted how ongoing reviews of the mathematics school curricula in England and Scotland, with renewed emphasis on problem solving, may offer further legitimacy

to TMSJ. However, they also highlighted the importance of considering how the official curriculum relates to teachers' practice in schools:

We need more of this [TMSJ] work and that endorsement from the National Curriculum [in England].

(Paani)

The National Curriculum [in England], for me, is just a political document ... But what teachers do in schools, and classrooms ... all those social practices ... I would call this curriculum making.

(Skye)

Some teacher educators identified an interesting anomaly in that teachers of lower-attaining groups (the very existence of which contradicts TMSJ principles) had more opportunities to try out TMSJ with these classes, partly because many students in these groups were disaffected with conventional teaching approaches, and partly because these groups were often seen by school leaders as low priority:

The bottom set Year 10 class ... Sometimes it's hard to justify moving away from the status quo, but it was so obviously justifiable [for them] because they weren't learning anything.

(Ava)

The opportunities, I've often found, come where people have, I suppose, given up on young people and said: "Oh well, this class is never going to achieve anything" ... "there's no opportunity cost here, so do what you like".

(Anna)

Teacher educators reported that one of the most effective ways of advocating for TMSJ was to enable teachers to observe its benefits in terms of the positive impact on students' motivation and engagement:

Where you do get opportunities to work differently ... just how significant the engagement and the enthusiasm is from young people ... the results are so exciting that they [teachers] then think: "Oh, well actually, some of that in my other classrooms could be really positive."

(Anna)

Subtheme 2.3: Challenging discourses and collaborative support networks

Teacher educators recognised how encouraging teachers to critically reflect on existing practice and deconstruct discourses was vitally important for enacting TMSJ:

To apply this [TMSJ] ... they [teachers] need to critique and deconstruct those prevailing discourses of maths and social justice first.

(Harriet)

They recognised the importance of teachers interrogating and developing their views of mathematics (as a discipline) and its purpose:

"What is maths? What are we teaching? Why are we teaching this?" And, as they [teachers] began to reflect on what maths is, and what the purpose of math is, it changed their attitude.

(Zuzana)

Teacher educators recognised the potential of collaborative support networks to facilitate critical reflection on existing practice and to explore alternatives:

One opportunity will be to create a reflective and collaborative community, where teachers engage in a dialogue about practices and experiences.

(Harriet)

They highlighted the value of networks, such as the TMSJN, for sharing ideas, experiences and resources:

The opportunities? ... having groups like this [TMSJN], and more resources like this, that will give teachers confidence to try different approaches.

(Megan)

Teacher educators highlighted how the collaborative and supportive nature of the research team helped to promote critical reflection, to identify and overcome constraints:

The fact that we are looking at these challenges together ... trying to come up with something that will resolve some of them ... looking at it from the perspective of what is stopping us.

(Ava)

Theme 3: Impact (of the project) on mathematics teacher educators

Subtheme 3.1: Reflections on design characteristics of the research project

The collaborative, dialogic and mutually supportive nature of the research team meetings, and the ongoing collaborative design of professional development workshops between meetings, encouraged teacher educators to share ideas and consider alternative perspectives, which had a significant impact on their thinking:

I find meeting colleagues like yourselves, face to face, fundamentally changes how I think.

(Robin)

The reason the project's made a difference ... having these conversations, listening to other people's experiences ... it's enriching ... and it's validating ... and it's challenging, all in equal measure.

(Alex)

It's wonderful to have an opportunity to work with people, to collaborate ... a huge learning experience because everybody's bringing so much ... different ideas and different areas of expertise.

(Zuzana)

Becoming part of the research team required teacher educators to commit time to the project over a sustained period, enabling them to prioritise the development of their thinking and practice around TMSJ:

Promoting socially just maths teaching is something that I've always been really passionate about ... the expectation and accountability of doing something, to then bring back and share, has meant that I have prioritised those things.

(Alex)

The funded nature of the project provided legitimacy for teacher educators to focus on TMSJ and justify devoting time towards the project:

[Universities] have an expectation of research outputs, or scholarship outputs ... having the BERA funding gives legitimacy to the work ... it really helped when I said: 'we need time for this'.

(Maya)

Subtheme 3.2: Developing thinking and practice of teacher educators

The project supported teacher educators' own scholarship and reading around theories and ideas relating to TMSJ practice:

It's also contributing to my scholarly work and research ... it's prompted me to widen my reading around this and think about how it can further contribute to my practice.

(Millie)

This project gave me the excuse ... to spend time reading and thinking about social justice in maths.

(Maya)

The opportunity provided by the project to refocus on theory strengthened and reinforced teacher educators' beliefs relating to TMSJ practice. It enabled them to enrich their teaching practice and to re-engage with aspects of their pedagogy which they felt had been previously neglected:

In terms of developing my own practice ... it's always been something I've been interested in ... it's been nice to reconnect a bit more with that.

(Maud)

The [project] has reinforced and reminded me of the importance of being a 'learner' with my learners, which is something I've always believed and held on to.

(Alex)

At the same time, the project prompted teacher educators to question some of their previous thinking and practice, identifying areas in which they had been inconsistent:

I felt sometimes, with my student teachers, I was telling them 'oh, you have to meet your students, your pupils, where they are ... build on their prior knowledge'. And then I wasn't doing the same with my student teachers.

(Maya)

They began to think differently about how to encourage teachers to engage with TMSJ issues, given their varying starting points:

I've been a bit too ambitious in what I was trying to do with our students. I think I might have scared them a little bit ... It will reduce the stress for them ... if there are smaller shifts in their pedagogical approach.

(Megan)

Subtheme 3.3: Developing confidence and agency of teacher educators

The project provided a supportive environment in which teacher educators felt able to develop their own voice, sometimes contrasting with other experiences of working within universities:

Sometimes, where you work, you don't always have a voice for these matters and these issues. And it's nice to be able to use that voice in this space.

(Millie)

The mutual support from a group of people who shared a passion for TMSJ gave teacher educators a greater sense of legitimacy in their own beliefs:

But just coming together and sharing with each other, I think, gives you the legitimacy to go back and work in your own context and feel as though you're not doing it on your own.

(Joe)

The project enabled teacher educators to develop greater confidence in challenging discourses around inequity and in advocating for TMSJ to teachers and colleagues:

I feel as if I've grown more confident in picking up some of those 'pedagogies of discomfort' ... and [being] able to initiate those conversations about 'well, how do we talk about, for example, disparities in wealth and relate them back to colonisation?'

(Millie)

I think the constraints are always going to be there, in terms of time, and curriculum constraints, and stuff like that. But it's given me the confidence to say 'yes, I'm going to do it anyway'.

(Alex)

DISCUSSION

The insights teacher educators shared into mathematics classrooms of student/practising teachers they worked with suggest that discourses and narratives that resonate with neo-liberal policies predominate in schools in both England and Scotland and appear to be gaining an even stronger foothold (Subtheme 1.1). This echoes Giroux's (2022) concerns over the rise in anti-democratic tendencies within education. The pressure on teachers of mathematics to adopt prescriptive teaching approaches as the best way to prepare students for high-stakes exams, outlined by teacher educators in the findings, is unlikely to address growing concerns around alienation, disengagement and disempowerment of learners highlighted by many researchers (Skovsmose, 2011; Williams & Choudry, 2016).

Deficit views of disadvantaged learners as lacking agency and ability, which the findings show were frequently encountered by the teacher educators in this project, are likely to reinforce the role that school mathematics plays as a critical filter contributing towards the reproduction of inequity within society (Jorgensen, 2016). In advocating for TMSJ, teacher educators often found themselves in direct opposition to prevailing discourses and narratives in schools. They also described how much of the professional development available to teachers does little to question existing practice and enhance criticality in challenging myths and discourses commonly evident in mathematics classrooms (Coles & Sinclair, 2022).

Teacher educators described how teachers, particularly those new to the profession, generally engaged enthusiastically with ideas relating to critical pedagogy (Freire, 1974) or critical mathematics education (Skovsmose, 2011) which they encountered (Subtheme 1.2). This highlights how many teachers' beliefs and dispositions resonate with Biesta's (2022) vision of a 'world centred education' and calls for a curriculum emphasising the development of critical understanding, individual and collective agency (UNESCO, 2015; OECD, 2018, 2024a). However, teacher educators also described how the constraints described above meant teachers they worked with found it difficult to enact this vision in the mathematics classroom. Student teachers, who are still in the process of constructing their beliefs (Vesga-Bravo et al., 2022), experienced a disconnect between the critical pedagogies that are increasingly promoted on ITE courses (Cochran-Smith et al., 2009) and the practice they encountered in placement schools, often leading to frustration and disillusionment. The challenge for teacher educators is therefore how to help transfer the enthusiasm for TMSJ ideas among teachers into widespread changes in practice across mathematics classrooms. This requires paying attention to the environment teachers are operating in, as well as their individual agency (Priestley et al., 2015).

Teacher educators described constraints they experienced working within mathematics teacher education, particularly in England, with the UK government imposing an increasingly prescriptive ITE curriculum on higher education institutions and other providers (Subtheme 2.1). These constraints echo Gabi et al.'s (2023) findings that teacher educators in England are left to work out how to develop decolonial and anti-racist practice for themselves and only those committed to this aim will find a way of doing so (sometimes only in a limited way). Reflections on practice shared by teacher educators during research team meetings helped them to develop a greater awareness of these constraints and how they had come to be positioned as critical educators within this working environment, resonating with Freire's (1974) idea of 'critical consciousness'. However, there were initial feelings of isolation and being unprepared to overcome these constraints, indicative of what Freire (1974) described as occupying a state of 'naïve consciousness'. At the same time, teacher educators articulated a growing sense of autonomy in their practice and began to identify opportunities within their working environment for promoting critical pedagogy among teachers (Subtheme 2.2). This included identifying aspects of government policy that legitimised TMSJ approaches, which were more noticeable in Scotland's Curriculum for Excellence, although still evident in England's National Curriculum. This concurs with Grudnoffa et al.'s (2017) argument that practice for equity needs to take account of political contexts, particularly true in mathematics education given its susceptibility to competing ideological interests (Ernest, 2014).

In the third research team meeting, the teacher educators highlighted the significant impact the project made on their own thinking and practice (Subtheme 3.1). This was attributed in large part to the research design, particularly to the collaborative, non-hierarchical and mutually supportive nature of the research team. The meetings provided opportunities to engage with research theory, which reinforced their commitment towards critical mathematics education (Skovsmose, 2011), whilst questioning and rethinking some of their previous thinking and practice (Subtheme 3.2). The ongoing critical reflection during research team

meetings, combined with opportunities to try out and evaluate ideas between meetings, enabled teacher educators to develop the confidence and agency to challenge discourses and more strongly advocate for TMSJ (Subtheme 3.3). This reflects the emergent nature of agency (Cathcart et al., 2026; Priestley et al., 2015) and suggests that teacher educators' participation in the project helped them to move from a state of 'naïve consciousness' to one of 'critical consciousness' (Freire, 1974).

There was growing recognition among teacher educators of the importance of teachers critically reflecting on their own practice and interrogating their own views and beliefs relating to teaching and learning mathematics and the nature of mathematics itself (Subtheme 2.3). Teacher educators highlighted the potential of collaborative support networks for promoting such critical reflexivity (Priestley & Drew, 2019), relating this to their own experience of how participating in the research team had impacted their own thinking and practice. The importance attributed to collaboration, critical reflexivity and social contexts accords closely with Grudnoffa et al.'s (2017) framework for equity-centred teacher education. Given the crucial role that external agents play in ensuring communities of inquiry are indeed critical (Jaworski, 2006), the findings demonstrate how teacher educators can play a vital role in fostering and supporting collaborative networks that aim to promote socially just mathematics education (Wright, 2024).

The project's findings highlight the power of communities of inquiry for cultivating critical reflexivity and agency. These ideas, along with Freire's (1974) notion of 'critical consciousness', can be applied at three different levels: to teachers working with students in schools; to teacher educators working with teachers in professional learning; and to teacher educators collaborating with peers in developing their own practice. In this project, we have focused on the second and third of these levels, demonstrating how teacher educators can play a vital role in fostering and supporting collaborative support networks among both teachers and their own peers, and ensuring that they are genuinely critical.

CONCLUSION AND RECOMMENDATIONS

In this paper, we have highlighted calls for an alternative school curriculum, embracing the power of critical pedagogies (Freire, 1974), which can develop the critical understanding and agency required to address social, environmental and economic crises facing global society (Wright et al., 2024). However, despite an apparent enthusiasm for critical pedagogies among many teachers, dominant narratives in schools, bolstered by increasingly pervasive neo-liberal educational policies (Giroux, 2022), serve to undermine teachers' efforts to enact such a curriculum. This is particularly evident in mathematics education, where powerful discourses contribute towards the continuing predominance of prescriptive teacher-centred pedagogies that neglect student agency and critical understanding (Wright et al., 2024). Thus, the potential for students to appreciate the power of mathematics, to harness this and use it to better understand the world around them and to support arguments and actions for change, is currently unrealised (Skovsmose, 2024). We have argued that teacher educators have a vital role to play in prompting teachers to question prior assumptions and beliefs about teaching and learning mathematics and the nature of mathematics itself (Skovsmose, 2011). This is exemplified in the design of the professional development workshops that we have made freely available via the TMSJN website (www.mathsocialjustice.org/prof-dev).

Our findings contribute towards a growing body of knowledge around developing classroom teachers' critical consciousness, confidence and agency in adopting critical pedagogies (Giroux, 2020), in particular the vital role that mathematics teacher educators can play in facilitating this. However, our findings generate knowledge in another area which has been previously neglected in the research literature, namely how teacher educators can

develop their own critical consciousness, confidence and agency in promoting socially just teaching practices to others. There is currently very little support and guidance, and limited time and space, available to teacher educators to help them achieve this. In this paper, we have identified enablers and constraints that shape teacher educators' agency and highlighted strategies that can be employed to help harness and overcome these. Whilst capturing teacher educators' voices is essential in understanding their agency, we recognise the limitations of this study in that the findings are based entirely on teacher educators' reflections and reports. It should also be noted that the research team was self-selecting, drawn from a network of practitioners with a prior commitment to TMSJ, and should not be considered as representative of all mathematics teacher educators.

Just as teachers need collaborative support networks (Priestley & Drew, 2019), so do teacher-educators. There are existing networks of teacher educators that provide space to reflect on practice in relation to social justice issues. These include BERA's Teacher Education Advancement Network, the Association of Mathematics Education Teachers (recently incorporated into the newly formed Association for Mathematics in Education), and the Teaching Maths for Social Justice Network, from which the teacher educators participating in this project were recruited. We hope that the findings from this project will provide useful guidance and support to those involved in organising and participating in such groups, and encourage teacher educators to seek out or establish their own support networks and communities of inquiry. We would also encourage governments and policy makers to encourage and invest resources in such groups, given their potential to develop a greater understanding among teachers and teacher educators of critical pedagogies and the nature and power of mathematics, as highlighted in this paper.

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CONFLICT OF INTEREST STATEMENT

The authors have no relevant financial or non-financial interests to disclose.

DATA AVAILABILITY STATEMENT

Data to support these findings (anonymised transcripts of reflective discussions during research team meetings) are publicly available (with no restriction) from the University of Dundee Discovery research portal: <https://discovery.dundee.ac.uk/> reference number doi: [10.15132/10000287](https://doi.org/10.15132/10000287).

ETHICS STATEMENT

Ethical approval for carrying out the research was granted by the University of Dundee (SHSL) Research Ethics Committee (reference: UoD-SHSL-E&S-STAFF-2024-25-003).

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Endnote

¹ Note 'student teachers' is used throughout this paper to refer to initial teacher education students, distinguishing them from 'students' in schools and 'learners' used more generally.

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