

The democratisation of teaching mathematics for social justice

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Volumes and websites that promote teaching mathematics for social justice present teachers with a list of non-traditional pedagogical goals and a selection of alternative pre-planned, project-based lesson plans. It is precisely this clarity that misrepresents the uncertainty embraced in Critical Mathematics Education, the philosophical tradition that the movement draws on. Both teachers and academics need tools to further scrutinise the pedagogical goals and lesson plans produced by the movement. The notion of generative themes introduced by Paulo Freire and the capability approach developed by Amartya Sen can serve as such tools. This paper analyses the relevance of both to teaching mathematics for social justice and explains how these tools can support democratic spaces for critique. In particular, it describes a workshop delivered at the British Society for Research into Learning Mathematics Conference as an example. It also discusses avenues for future research that arose from the delivery of this workshop.

Keywords: critical pedagogy; social justice; democracy; generative themes

Introduction

Teaching mathematics for social justice (TMSJ) is a growing movement in the UK, evidenced by the recent development and promotion of TMSJ teaching guides and websites (Wright, 2015). Like their American counterparts (Gutstein, 2006), these repositories introduce an alternative set of pedagogical goals in mathematics education. Students must learn mathematical knowledge by understanding and changing the socially unjust world that surrounds them. Teachers are expected to achieve this through a range of pre-planned, project-based lesson plans, and encouraged to engage with a series of brief articles that explain relevant terms, such as ‘social justice’. Ideally, they would also join research groups to discuss further articles and develop new lessons plans (Wright, 2021). The literature thus reveals a clear pathway forward for new educators looking to embark in the TMSJ field.

Yet this sense of clarity misrepresents the uncertainty embraced in Critical Mathematics Education (CME), the larger philosophical tradition that TMSJ draws on. CME has identified a non-exclusive range of issues in mathematics education, including a lack of attention to how mathematics shapes the world around students and teachers (Skovsmose, 2012). It remains an open question whether TMSJ pedagogical goals and lesson plans address these issues. They have for example been criticised for paying little attention to questionable uses of mathematics in society (Barwell, 2013) and the elevated value society ascribes to it (Pais *et al.*, 2012). The focus on *changing* the world also leads to an emphasis on mathematical skills with direct applications, such as arithmetic, probability and statistics. This leaves few to no lesson plans for units focusing on geometry, algebra and calculus.

Within the spirit of CME, teachers and academics need tools to scrutinise the pedagogical goals and lesson plans produced by the movement. In my view, the notion of generative themes introduced by Paolo Freire and the capability approach developed by Amartya Sen can serve as such tools. The first section of this paper analyses the relevance of both to TMSJ. The second section explains how each can support democratic spaces for critique. As an example, it describes a workshop delivered at the British Society for Research into Learning Mathematics Conference. The final section discusses avenues for future research that arose from this workshop.

Generative themes, the capability approach and TMSJ

At least two relevant dialogic tools have been developed to help a group self-reflect and critique its own understanding of social issues. The first stems from the field of education itself. Freire believed that the content of education should focus on generative themes, contradictions in perceptions and action across (and perhaps within) members of a community, which include “ideas, concepts, hopes, doubts, values and challenges” (2005, p.101). These perceptions and actions can be generalised at different levels, from society in general to smaller sub-units, such as cities and even classrooms. A key social contradiction Freire found across society was the desire for liberation in conflict with the continuation of domination, with teachers facilitating the latter. He identified these themes by letting members of communities discuss their perceptions of social contradictions, as well as resultant actions.

In my view, debates over TMSJ and CME have revealed a social contradiction within the mathematics education community itself. Crucially, TMSJ hopes to replace traditional and dominant approaches to mathematics education. It aims to empower all students to challenge social injustice with mathematics through a clear set of alternative pedagogical goals and lesson plans. Theorists in CME, however, make the more general point that the domination of any standardised, pedagogical approach needs to be challenged. Skovsmose, states that “any critical research programme will include a profound uncertainty [...] [and forms] an expression of concerns that continuously have to be reformulated, developed and reconsidered.” (2012, p.345) There is thus an apparent contradiction between the prescription of particular TMSJ goals and lessons on the one hand and the promotion of uncertainty on the other.

This supposed social contradiction is evident in practice. Nolan (2009), a teacher educator from the University of Regina, reports that her middle school teacher trainees prefer Gutstein’s work on TMSJ over that of other CME theorists. Her students explain that his work is directly applicable in practice, whilst that of the others is not. She fears that this feature of Gustein’s work obstructs proper critical reflection amongst students, with them blindly accepting his proposals. Whilst leading two groups of teacher trainees in the Lakeview District in the US, Bartell (2013) similarly found that students can be disempowered by teachers who simply copy or reproduce TMSJ lesson plans without critical reflection. It seems worthwhile for teachers and teacher educators to share their perceptions of this apparent social contradiction and its perceived practical implications. In other words, they should employ the strategies to deconstruct generative themes to the field of TMSJ itself.

Another useful democratic and dialogic approach can be found in the field of international development studies. In the 1980s, this field faced a similar social contradiction. At the time, the United Nations measured *human development* as the growth of GDP per capita. Consequently, the main evaluation tool of development projects became the measurement of income levels. Sen (1999) rejected this narrow

understanding and implementation of human development. He noted that common understandings of wellbeing instead encompass a wide range of capabilities, that is, states of being and actions that are valuable to people, which are not fully captured by income measurements. Examples include health and social relationships.

Sen's challenge to the dominant framing of human development walks a fine line between the development of alternative objectives and the need to continually scrutinise these objectives. The economist spearheaded the creation of alternative indices that measure the multitude of capabilities that encompass development. He also warned, however, that the creation of a universal and timeless index is impossible. In his view, human development stems from the value that individuals in a community ascribe to different elements of their lives, leading to inevitable variations across contexts. Accordingly, the capabilities that are included in indices and their respective weighting towards one another should be formulated and continuously reformulated through public debates within a given community.

In a similar vein, the critical elements of TMSJ can be deconstructed through public forums. The multidimensionality of education is already well-recognised in the field. Cotton (2001) has proposed a break-down of CME into five different dimensions and political aims: building on learners' heritage; bridging informal and formal mathematical traditions; promoting collaboration; encouraging learners to read the world with mathematics; and moving towards learner autonomy. Capability Approach theorists have also applied collaborative methods, such as group interviews with students, to identify which of these dimensions of education are valuable to learners (e.g., Biggeri, 2007). A logical next step is to create collaborative spaces for teachers to deconstruct and evaluate the different dimensions of the TMSJ movement.

Workshops as democratic spaces

There are different spaces where generative themes and multidimensional indices for TMSJ could be developed, from teacher break rooms to online forums to conferences. Each comes with its own limitations and opportunities. The workshop designed for the British Society for Research into the Learning of Mathematics serves as an illustrative example. Single-event workshops at national-level conferences bring together a group of individuals from different local contexts, with varying ideas, beliefs and understandings. They also put an artificial limit on the time participants have for discussion. Accordingly, a balance has to be struck between the free exploration of participants' perceptions and adherence to a tight schedule. In other words, the workshop designer must impose a semi-structure upon the discussion.

The notion of generative themes and the capability approach can provide such a semi-structure. In the first section of the delivered workshop, participants shared what they understood as TSMJ and CME, and explained personal experiences of its implementation in practice. Direct quotes from key authors were provided to prompt discussion about the apparent social contradiction in the field. The choice to collate direct quotes rather than brief summaries was deliberate. In line with its commitment to fallibilism, CME authors are cognisant of the variations of interpretations that can stem from a single text. In her exploration of the notion of *mathemacy*, for example, Chronaki (2010) presents a series of images, quotes and literary extracts, without clear instructions on how to piece each together. The reader is left to weave their own definition together and thus forced to enter an open-ended discussion. In a similar manner, it was up to workshop participants to determine what quotes meant to them.

The second section invited participants to deconstruct lesson extracts, identifying and discussing the elements that they consider critical and uncritical. The inclusion criterion for lesson plan extracts was that the creator themselves classified the lesson as belonging to the TMSJ movement. This ensured participants, rather than the workshop designer, had the opportunity to decide whether classifications were appropriate. For similar reasons, the lessons were presented through the creators' own words. In total, three lesson plan extracts were selected from a range of mathematical topics and authors.

The first lesson sample was taken from Avci (2019, project 4) and presents a fictional story in which an organisation constructs a building for residents in need. Students must split the building plan up into individual units and family units, by setting up a simultaneous equation and reflecting on fairness. Afterwards, students discuss ideas as a class and write independent reflections. The second sample is a multiple choice test discussed by Steffens et al., (2021, figure 9.3). Students can only answer questions correctly if they both know statistics terminology such as 'affect', 'correlate', 'average' and 'increase' and facts about global warming. The third lesson sample was taken from a blogpost from Woldum (2016). It invites students to co-construct physical 3D sine wave models. They first complete tables to calculate lengths, cut pieces of string, attach ice lolly sticks, and arrange these on a frame.

Future avenues of research

My own reflections as a workshop facilitator cannot do justice to the rich experiences and viewpoints shared by participants. Nevertheless, in my view, two key discussion points arose in the meeting that merit further discussion. First, of all, the difference between CME and TMSJ may be relevant to newcomers in the field. Most participants did not associate the third lesson extract with the TMSJ movement, because of its lack of explicit content about social justice issues. This raises a few further questions. Is this an appropriate reason to disqualify a lesson as TMSJ? And if so, does the lesson still belong to the CME field? It could be argued that CME employs a broader understanding of social justice, appreciating the role of explorative and collaborative learning activities in its promotion (e.g., Criticos, 1993). Or alternatively, that it appreciates any nonconformist approach. Finally, should these different kinds of classification matter for the pursuit of critical teaching practice?

The literature seems to overlook the apparent need to discuss these possibilities in further detail. Skovsmose (2016) lists TSMJ as one amongst many critical approaches, including ethnomathematics, the pedagogy of dialogue and conflict, and responsive mathematics education. Nevertheless, he refuses to explicitly distinguish TMSJ from other fields in CME, because TMSJ "is a label that is currently used quite broadly" (Skovsmose, 2022, p.2). Terms such as social justice are indeed contested. However, participants in the workshop had particular expectations of what social justice involves and were able to disqualify lessons accordingly. It is an open question whether others would agree with such classifications. Explicit attempts by the literature to contrast expectations of TMSJ lessons with expectations from lessons of other CME branches would be helpful. Teachers can then decide whether unexpected routes are also worthwhile.

A second discussion point involved the exploration of different dimensions of critical education. Through comparisons, participants both picked out good practice in the lesson extracts, as well as opportunities that were missed. For example, they noticed that lesson extract one posed a more critical open-ended question, whilst

lesson extract three imposed final answers upon students through multiple choice questions. Other critical elements in lesson extracts included collaborative work, opportunities for reflection, explicit exploration of social justice issues and links with students' actual lives. A further question is whether these different critical dimensions are individually or jointly sufficient for a lesson to be truly critical.

Finally, the discussion of lesson extract one revealed that seemingly critical elements can lead to disempowerment. Learners were for example asked to find an appropriate allocation of single rooms and family rooms without consultation of the larger community. The lesson thus singled mathematics experts out as final decision makers over more democratic approaches. The activity also implies that simultaneous equations serve as good models for architectural decisions. However, these models cannot account for the limits that the shape of buildings and available land impose on the possible arrangements. Examples like these artificially fit a mathematical topic into a social justice issue. It signals to students that the topic is only relevant to semi-realistic problems, or deceives them about its actual utility (e.g., Ernest, 2021).

Conclusion

In summary, the TMSJ field promotes more rigid proposals for mathematics education than the broader CME field. Teachers and researchers need tools to democratically assess these proposals. The juxtaposition between the more prescriptive TMSJ and more uncertain CME proposals can be explored as a Freirean generative theme. Following the multidimensionality of the capability approach, TMSJ proposals can also be broken down into multiple critical dimensions. Participants in the workshop developed their own interpretations of key quotes and lesson extracts. Their responses confirm a potential disagreement about what counts as CME and TMSJ. They also reveal critical and uncritical dimensions of lesson plans that can serve as ideas and warnings for prospective curriculum developers.

Workshops still come with limitations, however, including accessibility issues, time limits and the control of moderators over the discussion and published summaries. It may be worthwhile to instead make the suggested democratic tools available in spaces for large-scale public discussion, where participants' own interpretations remain accessible. The capability approach found such a space in assemblies of the United Nations. Possible larger democratic spaces for the deconstruction of TMSJ include teacher journals, teacher associations and online forums. Imagining UN-scale discussions on the theoretical commitments of TMSJ may sound unrealistic and farfetched. Nevertheless, if the movement hopes to remain self-reflective and considerate of the voices of all educators, this is what it takes.

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