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ANTI-RACIST AND DECOLONIAL PRACTICE IN TEACHER EDUCATION

Manjinder Kaur Jagdev

York St. John University
m.jagdev@yorks.ac.uk

ABSTRACT

Postgraduate Certificate of Education (PGCE) mathematics students work in groups to create lesson plans and resources about the historical and cross-cultural roots of mathematics, with written reflections on celebrating diversity. Last years' lesson activities included: 'The Game AYO', 'Yoruba Number System', 'Towers of Hanoi', 'Crop Circles' and 'Tangrams, Sudoku and Kenken'. The students reflected on the implications on their classroom teaching with pupils, relating to unconscious bias and decolonisation of the national curriculum. At the summer British Society for Research into Learning Mathematics (BSRLM) workshop 2021, ideas were shared from university colleagues and students at York St. John University and for classroom teaching. BSRLM colleagues contributed to the Padlet for initial teacher education. Collaborative curriculum development practice takes place with student teachers, involving lesson planning of activities for classroom practice in placement schools. Reflections about critical mathematics education is outlined with feedback from pupils. Learning about contributions to mathematics from people from around the world can help pupil engagement and interest, whilst addressing diversity, inclusion and social justice issues.

Keywords: anti-racism; decolonial practice, critical mathematics education, social justice

Professional practice

Prior to my work in higher education, I was a secondary school mathematics teacher for 10 years, working in British comprehensive city schools in England. Since 2006, I have worked in higher education with student teachers. My motivation comes from classroom experience where pupils become more engaged when learning about historical and cross-cultural roots of mathematics. There were higher levels of classroom talk and children made links to other areas including languages.

As a result, every year, I have taught a session on the historical and cross-cultural roots of mathematics, with PGCE mathematics students. Contributions include Chinese Tangrams, Vedic mathematics, Multiplication tables in different languages; Symmetry and African patterns in art / crafts / textiles, Students work in groups to plan lesson

activities. The purpose of engaging in such activities includes to teach pupils that mathematics has contributions from all over the world, over many centuries.

In the summer of 2020, I followed this with a second session following the death of George Floyd. I shared a paper by Peggy McIntosh on White privilege and a paper by Vini Lander and Heather Jane Smith about student teachers' and ethnicity which generated rich discussion. In an online session, the PGCE mathematics students discussed the issues of White privilege, unconscious bias and decolonising the curriculum. One student reflected:

'I was really surprised to see how high the percentage of White British teachers (who) are entering the profession is (Smith & Lander, 2012), and I wondered why this may be. I feel teaching is a profession which many people are inspired to explore as a result of their time spent in school as students. One of the key ingredients here are the role models students are exposed to. I wonder, if ethnic minorities in Britain were more fairly represented in the teaching profession, whether students from a variety of ethnic backgrounds would see the profession as one they could more closely relate to, or see themselves taking part in. A subconscious barrier may be being created among students that dissuades them from considering a career in teaching, as they do not fit the teacher stereotype that this unfortunate imbalance of ethnic representation has created. This is a vicious cycle, and one that will take years to alter.'

Due to the timeliness, PGCE mathematics students reflected on the implications on their classroom teaching with pupils, in relation to the following, and discussed their knowledge of the Civil rights movement, the Native American Indian experience and history of colonialism. They discussed white privilege, unconscious bias and decolonisation of the national curriculum for primary and secondary education.

Literature

Good practice in initial teacher education institutions is shared and effective within ITE programmes, including at YSJU, where student teachers are taught and encouraged to practice anti-racist teaching in their placement schools. Further, mathematics education should prepare students to investigate and critique injustice, and to challenge, in words and actions, oppressive structures and acts (Gutstein, 2006, Gutstein and Peterson, 2006). Mathematics has everything to do with a new revolutionary world order which is urgently needed as humanity faces the existential crisis of climate change. Our hopes for the future depend on learning the lessons of the past (D'Ambrosio, 2007). The responsibility, as mathematics educators, in preparing students to shape a new civilisation, in which social justice and peace with dignity for all prevail (D'Ambrosio, 2008). Alternative and contradictory mathematics teaching approaches can be brought in, incorporating potentially oppositional voices (Candia Morgan, 2010) and this highlights the importance of including Indigenous voices to education. Tony Cotton (2012) challenges educators to envisage an education system which sees as its goal a

more socially just world. He explores the question of how education, both formal and informal, can positively impact on all pupils' life chances and life experiences.

More recently, Skovsmore (2020) reflects on mathematics that addresses social and ethical issues. The equitable practices (Weber et al., 2020) of critical mathematics education demonstrate a richness of reflections could serve as role models for research. The Teaching mathematics for social justice network (TMSJN) was set up by Wright (2021) for mathematics teachers in all phases (primary, secondary and tertiary) committed to addressing equity and social justice issues. Barwell, Boylan and Coles (2022) support a relational and dialogic perspective to the global crisis in the context of mathematics education and the living world. In Coles et al. (2022), mathematics teachers share their experiences of using resources that explore climate change in secondary school lessons. One of the resources is the short video featuring Greta Thunberg and George Monbiot: <https://www.youtube.com/watch?v=-Q0xUXo2zEY>. The context of climate chaos leading to floods, droughts and exacerbating inequality is explored in Alf Coles and Tracy Helliwell (2023), to ask what the role of mathematics education is and what mathematics teacher educators can do in supporting teachers to respond to global challenges, and the associated injustices, within their mathematics classrooms.

Session feedback

I have led various conferences for our undergraduate primary and postgraduate secondary student teachers. These have been positively received and feedback includes:

I am going to make sure I use lots of the resources Manjinder showed us as there were so many and i have noticed when doing my research for my wider curriculum essay many subjects, especially history and science seem to be very white male dominated.

It has given me a really good insight into the backgrounds children may have and how best to respond to this. It's broadened my knowledge on things I didn't previously have a lot of knowledge on and ways in which I can improve my teaching and outlooks.

have realised the importance for the need on a push on the change of the literary canon taught in schools and the curriculum!

The links between colonialism and climate change are very interesting. Honestly, would have never made those connections before today

As a History trainee this is making me begin to feel quite ignorant in the face of diversity in my teaching. It's definitely going to make me be mindful of this going forward

referring to previous: In Music, we did a lesson on the slave trade to give context and an introduction to the origin of blues. I try to say "enslaved

people/persons" rather than "slaves". thinking about the language i use. Advice on this told me that slave isn't an identity, rather a circumstance

Were currently unpacking representation and why it's important in literature and the media. I used Marcus rashford for this as he's very relatable and many of the boys s in the class are football mad.

we are currently discussing Marcus and Malala on our 'Inspirational people' module in English

am teaching of mice and men though soon (which is unfortunately a v racist and sexist text) so I will be trying to build in some discussion time and reflection time for students as well as addressing the issues

Further activities I have shared with the student teachers in mathematics sessions include mathematical patterns in Islamic tiling and in Native American Indian designs with links to art / symmetry, mathematics in African textiles, and patterns in Aboriginal designs which links to storytelling about creatures and Earth. As part of my own research, I explore the following questions:

How can teacher educators facilitate student teachers to embed critical mathematics education and social justice issues in schools?

How do student teachers experience critical mathematics education through a participatory action research approach?

What are the implications for initial teacher education and ongoing professional development?

Positionality

My philosophy of education is influenced by the African Ubuntu beliefs of human interdependence that Waghid (2020) suggests could be part of higher education through social responsibility, deliberative engagement, attentiveness to others and otherness. This connects to Mike Ollerton (2012) view of the value of group-work in mathematics and the work of Malcolm Swan (2006) focused on collaboration through discussion where children learn from their peers. This fits in with the learning theories of social constructivism (Vygotsky, 1962) and importance of language in learning.

My positionality is based on my faith, Sikhism. This religion was founded by Guru Nanak Dev Ji, the first Sikh guru, at the end of the 15th century and spread by his nine successors. In addition, Sikh gurus and saints were strong believers of gender equality (Kaur, 2010). Over two million Sikhs live in more than 50 countries around the world (Garha and Domingo, 2017). Sikhism has a focus on care for the environment, the Earth and its creatures. Sikh selfless service (*seva*) 'should include social and environmental advocacy.' (Prill, 2015, p. 233). Thus, my interest in critical mathematics education with its focus on social justice, stems from my faith. EcoSikh is an organisation, from the Sikh community, responding to the threats of climate change and the deterioration of the natural environment. Guru Nanak Dev Ji laid the foundation for a sacred vision

for the environment in the following translated words in the epilogue of the morning prayer (Jap Ji Shahib: ‘Pavan Guru Pani Pita’):

‘The Air as the Guru, the Water as the Father, the Earth as the Great Mother, are each important to us.’

Methodological choices

We are working collaboratively to understand decolonisation of the curriculum as a practical enterprise and promote the practitioners’ voice in this process by placing them in a central position as decolonial curriculum makers (Priestley and Biesta, 2013). This professional learning of a collaborative design is linked to problem-solving in mathematics lessons, mastery and Japanese lesson study ideas (Swan *et al.*, 2015). I draw from post-colonial and decolonial thought (Fanon, 1961) and critical race theory (Crenshaw, 2011). In a recent session on decolonising the language of the national curriculum, PGCE secondary student teachers discussed adopting inclusive language for all and acceptable language / terms used in school. Student teachers are provided with the opportunity to explore the latest article published about the Anti-racism ITE/T Framework, entitled "Finding pockets of possibility for anti-racism in a curriculum for student teachers: from absence to action". This allows student teachers to challenge stereotypes in their work in placement schools.

The process of deconstructing and reframing the mathematics national curriculum is an essential feature of the decolonising process which will give teachers the confidence to be creative and innovative. Pupils can learn through stories and discussions, with feedback from children, mentors and student teachers. We will use stories and re-visit ideas throughout the year, increasing the level of engagement, countering fear and anxiety in mathematics (Boaler, 2015).

The methods of lesson observation, interviews, classroom discussions between student teachers in university-based curriculum sessions, and email feedback will be used. Additional data will be garnered through feedback from mentors (school-based teachers) and documentary data formats such as lesson plans, student teachers’ reflections, and pupils’ feedback. Since this enquiry is purposeful, multi-perspectival, personalistic, situational and interpretative, this research aims ‘to demonstrate the complexity, texture, nuance involved in how individuals and groups experience themselves and their worlds.’ (Kamberelis and Dimitriadus, 2005). As fellow travellers on a journey of development, student teachers and I are engaging in a creative, evolving, exploratory process where we have the freedom to co-create activities on the themes of critical mathematics education and social justice for classroom practice.

The impact of this project is to change the national curriculum in primary and secondary schools and classroom teaching practice. Hearing and listening to the voices of under-presented groups will lead to greater understanding between different groups of people for social justice. By tapping into knowledge of pupils, teachers, educators and wider

community, this project aims to empower people to make positive changes in society to ensure that people are not judged by the colour of their skin but by their talents.

Kanter *et al.* (1992) argue that the first step to implementing change is building coalitions of stakeholders. The different groups of beneficiaries include stakeholders such as pupils, ITE colleagues, student teachers, partnership teachers, parents, the wider community, the wider profession including subject associations and research organisations. The locus of change includes raising of the awareness of a multicultural society including in geographically predominantly white areas where whiteness can be seen as the norm. This creates a culture where the impact is a beneficial change of anti-racist and decolonial practice in learning and teaching.

Ongoing research

A sample of PGCE secondary mathematics and undergraduate primary student teachers, are collaborating amongst themselves to create lesson ideas and activities based on critical mathematics education for use in their placement schools. These include sustainable travel for Years 3 / 4, Food miles project, using the Fare Share webpages: <https://fareshare.org.uk/> (supported by the footballer Marcus Rashford), the BBC Bitesize Key Stage 1 resources ‘The Regenerators’ and the Worldometer <https://www.worldometers.info/> page for live data.

After I planned a series of activities based on the topics of Rising Sea Levels, Plastic Waste, Child Labour, Fast Fashion and Food miles, my student teachers discussed these for adapting in their own classrooms in placement schools. In February 2023, I had the pleasure and privilege of observing a lesson taught by a PGCE secondary mathematics student teacher. His focus was data handling and statistics of climate change, that included his pupils (aged around 15 years) learning about the island of Tuvalu that is sinking. The lesson included group-work and discussion by pupils with feedback as a plenary. The student teacher began the lesson by sharing a video of Tuvalu which was an excellent hook of up-to-date information that included graphs, percentages, area and temperatures relating to fossil fuel consumption. Children made links with other curriculum subjects like science and geography. The learners accessed the ‘Climate Change Analysis’ activity about correlation and lines of best fit in a real-life context. One pupil stated that often when working on their own, they get stuck and do not what to do. In this lesson’s scenario, it was better because they could discuss their ideas: **‘teamwork helps us work it out.’** Pupils made comments about the ‘positive correlation’ they observed from the trend and stated:

I wonder if the progressing extreme heat will affect our animals and even, human beings. Will this affect us in dangerous ways? For example, will we die

from heat stroke, will the water sources dry up and the animals die of thirst? These are my wonders for this graph.

I already knew climate change was a problem, but understanding the statistics behind it allows me to see the scale of the problem and how it will affect our lives in the future.

learning this mathematics to challenge misleading / fake news

the experience was like being in future employment - all coming together to work on a task

The student teacher reflected:

A critical mathematics education was incorporated into a Year 10 scheme of work on analysing statistics. The students all came up with fascinating statistics on climate which motivated them to want to understand the problem. The students collaborated in group projects and produced well-informed data driven discussions across the classroom. The sequence of lessons had many positive impacts, including:

- *Develops critical thinking skills by questioning assumptions, challenging narratives and engaging in meaningful discussions.*
- *Promotes social justice and equity as students are informed and engaged in socially responsible mathematical practices.*
- *Enhances problem-solving skills by learning to approach problems in a critical and reflective manner, students become better problem-solvers and are better equipped to tackle complex issues in a variety of fields.*
- *Increases engagement and motivation because they see the relevance and importance of the subject matter to their lives and the world around them.*
- *Fosters creativity and innovation through approaching problems from multiple perspectives.*

Following a lecture on critical mathematics education, some of the undergraduate primary student teachers provide the following insightful reflections:

I found it very interesting and feel I would've benefitted from this approach if it had been used in my mathematics lessons during my own primary school experience. I think the implications for children would be that it makes mathematics more engaging and purposeful. For myself, it would help me teach mathematics in a more interesting way and it would help me to create more hands-on mathematic lessons.

By incorporating mathematics with global events (T)he children learn more about the world they are living in and the impact of what our actions has on the planet. Also they are able to explore the different ways that maths can be used to help find a solution to the problems and embeds the fact that mathematics is used in everyday life even if we are not always aware of it. Can further

encourage the children to take what they have learnt in the classroom and apply it to their home life and teach their parents. It is important to use in the classroom as it provides the children with different views of the critical education within mathematics and how it links to the world not just being used inside a classroom.

Using real-life problems as a hook into a topic - LOTC (Learning outside the classroom) opportunities; Implications - Critical thinking skills; Fosters creativity; Can help them be engaged with a mathematics lesson (helpful for Those who find mathematics stressful); Teaches them about real world issues. Importance - It is about their future and what they can do now to help save it - Address a wide range of ethical situations.

The primary undergraduate student teachers created inspiring lesson activities linked to the mathematics national curriculum on a plethora of social justice themes including the following that I have grouped into similar themes:

Saving sea turtles (plastic pollution); Landfill pollution, Plastic consumption, Pollution in the oceans and seas; Litter in the ocean; Litter picking; Recycling; Greenwashing

Food miles; food poverty; Rate of inflation for food; Sharing food and resources - chocolate and fair trade; Food waste; Healthy diets

Environments around the world - mountains, rainforests and cities; Deforestation, Climate change, Rising sea levels; Global warming and melting ice caps

Air quality, Australian Forest fires, Turkish and Syrian Earthquake crisis; Carbon emissions; Carbon footprints

Cost of living crisis, Fair trade and sustainability; Budgeting

Biodiversity; Endangered animals

Fast fashion.

This work aims to bring together ITE colleagues, student teachers, school mentors, pupils and perhaps even their wider families to discuss activities based on anti-racist and decolonial practices, social justice themes and critical mathematics education. This research aims to benefit children and adults so that they are more able to deal with inequality, bias and false information, creating a better and fairer society with equal opportunities for all. We are on a long intersection of journeys to inform knowledge in which we recognise cultural and social capital including race, class, and ‘other’ voices. This is a flexible and adaptable process where different types of knowledge are shared and valued, leading us to further develop as reflective practitioners in education.

By teaching critical citizenship through mathematics and challenging British values as human values across the globe, we can question the assumptions underpinning governmental agenda, including the language, prescriptiveness and associated notions of power and control used in national curricular. Adapting our practices to work within the barriers of testing, standards, and a ‘narrow’ curriculum, educators can aim to work towards a broader, global perspective to highlight pupil voice and knowledge in

curriculum. Reminiscent of Kotter's (1996) 8-step model for managing change, we can help others to see the change by bringing together groups to guide, provide a vision in as many ways as possible to engage in conversation, keep the level of morale high over time, outline short-term benefits and empower voices, promote voices of under-presented groups and keep up the motivation to create and consolidate a new culture.

Concluding remarks

Young adults have influenced the changes to the Welsh national curriculum to make Black history lessons mandatory (Morris, 2021). The Anti-racism in Scotland: progress review (published 28 June 2023): <https://www.gov.scot/publications/anti-racism-scotland-progress-review-2023/pages/1/> highlights the Anti-racism in Education Programme, the Anti-racist Employment Strategy and the work being done in Health and Social Care to embed anti-racism. It is hoped that our work will influence English curriculum and policy. School-based colleagues' participation in this project as curriculum co-creators impacts their professional development. We are empowering the next generation of children to become critical thinkers to solve the global problems that the world faces such as climate and racial justice issues. These two are interlinked colonialism and imperialism such as 'othering', extraction of resources, leaving nations poorer and now dealing with devastating effects of environmental problems. We should discuss the ethics of teaching mathematics by using real world examples such as Covid, global warming, pollution of the environment, health and mortality figures from around the world, statistics on gender and race inequalities to show the impact of models, measures and mathematisation (Ernest, 2021). One of the current PGCE secondary mathematics student teachers recently reflected:

I think, where possible, I will embed critical maths education in all areas. For instance I'm teaching about salaries to year 9 next week and will try to open a discussion about the two wages I have put on the board, a cleaner at £20k and a Software Engineer at £50k. I am also experiencing similar things inadvertently in other lessons too, and it's made me realise I wasn't prepared for some questions - for example I started to teach lattice multiplication as a method of decimal multiplication and referred to it as Napier's bones. The first questions were "why is it called that?", followed up by "Who was Napier?" - to which I couldn't answer. What I should've done in the lesson is google after I set some independent work but I'm going to try to think about that in advance for next time. The implications for children is that if we don't raise these, at least in part, then we have not done all we can to help prepare the students for the real world. It may be that they forget everything, but that doesn't matter. It is important to include critical maths and social justice themes for the reasons above, as well as for the wider impacts and cross-curricular connections that could be made by doing so. If we talk about Alan Turing in maths and History are doing a WW2 topic and do the same then we might start marking more connections in the brain and the students may remember more of the content.

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