

# Creating space for socio-mathematical agency in the primary classroom

Joel Kelly<sup>1</sup>, Caroline Hilton<sup>2</sup> and Pete Wright<sup>3</sup>

<sup>1</sup>The Blue School (C of E), London, UK; joel.kelly@theblueschool.com

<sup>2</sup>University College London, Institute of Education, UK

<sup>3</sup>University of Dundee, Education and Society, UK

*In this paper, we consider the benefits of creating space for socio-mathematical agency (SMA) for students in the primary classroom. Both a lack of time in the school day and curriculum constraints can often mean that there is little to no space for children to develop their SMA in the primary mathematics classroom. We report on a project that involved working with 6 teacher researchers and created space for them to collaborate, plan, deliver and reflect upon maths lessons that had social justice elements relating to the students' lives. We found that the teachers' attitudes towards the curriculum were challenged and that they saw the benefit of SMA. During these sessions, teachers noticed a positive impact on their students who showed increased levels of engagement as well as the ability to make links between maths and the social justice issues in their lives.*

*Keywords: Primary mathematics, social justice, teacher judgement, PAR, issues.*

## Introduction

In this paper, we consider the benefits of teachers creating space for socio-mathematical agency (SMA) and the impact this has on their students. In previous projects, Pete Wright (2021, 2022) has looked at introducing social justice to the mathematics classroom and to help students and teachers to see the benefit of combining the two. This is continued in this project using the primary school setting. SMA is defined as: “the ability to use mathematics effectively to argue collectively for social change” (Wright, 2022). Yasukawa et al. (2016) argue that educators should open up real-life situations to reveal their hidden ethical implications, thus bringing another layer of social awareness to students. Skovmose (2011) argued that educators need to encourage students to become active citizens who use their maths skills to solve social issues and inequality. Weideman (2002, p. 205) noted: “It is clear that attention to social justice is now even more critical than ever followed by a move to incorporate more social justice preparation”. There is a field of supporting research (Gutstein, 2006; Manyukhina & Wyse, 2019; Schoenfeld, 2012) that argues the benefit of bringing social justice into the classroom and solving meaningful real-life problems.

A lot of primary schools in England follow the Maths Mastery programme or schemes that prescribe coverage and leave little to no room for teacher judgement/creativity (Williams, 2020). These schemes ultimately remove opportunities for SMA as the tasks are one size fits all and do not leave room for children to apply the learning to their own world. Our previous experiences of working with teachers following these schemes suggests that they have found it difficult to add any extra material to the already busy curriculum. Without time or space for SMA, we argue that the teachers are missing out on opportunities to apply the maths learning intentions to real-life problems from the world in which their students live. Furthermore, the children miss out on making vital connections between

the maths they learn in the classroom and the world that they are growing up in. We argue that more needs to be done to make those vital connections and to help children develop SMA.

We share Biesta's (2015) view on teaching, in which teacher judgement is essential in pedagogy as well as planning and delivering the maths curriculum. The teacher should be able to respond to their individual environment and operate within the constantly changing landscape (Biesta, 2015). Teachers should open up new opportunities for children to explore and apply classroom learning to their own individual lives (Biesta, 2015). There is much research (Ball, 2003; Cowie et al., 2007) on the teacher as an individual who should be allowed to use their teacher judgement. Many researchers (Leander & Osborne, 2008; Leat, 2014; Pyhältö et al., 2014) have explored the classroom as a constructed and policed area that ultimately limits the room for teacher judgement and ultimately for opportunities of SMA. The SMA approach cannot be mass-produced and is often not found in the schemes that are present in the majority of classrooms.

In the same manner as the research that precludes this project, we used the participatory action research (PAR) model (Wright, 2021). PAR can be used as an effective tool to quickly tackle oppression and injustice (Nygren, 2009). It provides opportunity for self-reflection (McNiff, 2013). Skovmose and Borba (2005, p. 214) note that PAR allows for possibilities to be "imagined and alternatives that can be realised". Furthermore, Andersson and Valero (2016) challenged traditional pedagogies in secondary schools by using PAR. Researchers working alongside the teacher researchers (TRs), using PAR, can lead to genuine transformations in classroom practice (Wright, 2021).

### **The Primary Maths and Social Justice (PMSJ) Project**

Drawing from previous work in the field of teaching maths for social justice (Wright, 2016; Wright, 2017; Wright 2022), we set out to improve opportunities for socio-mathematical agency (SMA) in the primary classroom. We worked with 6 TRs across two schools in West London over the 2021/22 academic year. Both schools were following the Maths Mastery programme, a curriculum scheme that aims to offer a deep and conceptual understanding of maths. We used the PAR model, established in a previous project (Wright, 2021), to allow TRs to plan, deliver, reflect and improve their practice and to seek positive social change. The authors played a largely facilitative role. There was an introductory meeting followed by two PAR cycles, each of which began with a research team meeting that focused mainly on planning the research lessons and concluded with a research team meeting that focused mainly on evaluating the research lessons. The TRs worked in pairs to complete the detailed follow-up planning of research lessons. Each pair was supported by one of the authors. One example of this was two of the TRs working together to create a lesson about sharing in relation to fairness. These TRs planned the lessons together for two year one classes. They created space within their lesson for the children to input something that they would like to make fairer. In the lessons one set of students decided to look at how to share a special play area in the school playground and the other chose to come up with a system for dividing up what they did, and for how long, in their golden time (reward time). The teachers were then able to deliver, reflect upon and share their experiences of these lessons and their impact with the TR group.

The PAR process gave opportunities for the TRs to self-evaluate and share their findings. Whilst no form of gathering data gives us the full story, hearing from the teachers themselves gives us a useful insight into their experiences and their classroom.

TRs were interviewed at the start and end of the project to capture their experiences. They also had opportunities to share their thoughts in our meetings. Data was collected, in all of these sessions, through audio-recordings. Thematic analyses were then carried out on these transcripts by the authors in order to assess the effectiveness of strategies used by the TRs in enhancing students' SMA (research aim 1) and to assess the impact of the project on the teachers' thinking and practice (research aim 2). Our coding process was a mixture of inductive and deductive (Braun and Clarke, 2022). We began with the codes related to our theory and then developed our coding to embrace the new themes that emerged from our reading of the data. A full account of the research can be found in the project report (Wright et al., 2023).

This paper puts TRs' experiences under the microscope. We wanted to see what was the impact of increased SMA on the students and teachers as well as the obstacles that may prevent it from taking place in the primary classroom. In the following sections, we present and discuss the themes that emerged from the findings. We have done this by dividing the sections as follows: Constraints of the Curriculum; Increases in Student Engagement and SMA; and Opportunities for Professional Development.

All of the teachers' names below have been replaced by pseudonyms.

## **Constraints of the Curriculum**

There was a clear consensus that the Maths Mastery scheme was "jam-packed" (David, Interview 1) and that this as well as everyday time restraints left little room for the teachers to add their own input. All of the TRs saw the curriculum coverage in school as excessively large and the theme of it as an obstacle ran through the interviews:

I think constraints of the actual curriculum is probably the major one really. Like if you reduce the amount that children need to know at certain age groups, you can not only learn the maths in depth... but you could relate... the mathematical topics to real-life scenarios. And without any change now, I think it's very difficult to... because you just don't have the time to have these conversations every day, as great as they are. (Aidan, Interview 2)

The constraints of the curriculum and lack of room for teacher judgement, in this case, remove any genuine opportunities for SMA. The TRs returned to the idea that teacher social justice within maths was something they saw benefit in but could not see how more content could be added to the already fully loaded curriculum. One TR commented on how challenging it would be to keep planning extra social justice lessons alongside the current curriculum, as they would not only need to plan it in line with the learning intentions from the curriculum (so as not to get behind with the scheme coverage) but also work out a way to combine it with the scheme. This is above and beyond the already heavy workload that teachers currently endure.

All of the TRs saw the value of including linking social justice to their maths lessons and promoting SMA. Half of the TRs offered thoughts on how social justice fits in currently with the curriculum with some stating that the lessons felt like standalone lessons. They were also keen for them not to be tokenistic:

It's finding the right fit and being conscious that there's a big curriculum to fit in... I think, like, the democracy lesson that we did was fantastic, and that was almost like a standalone lesson. (David, Interview 2)

The issue here lies with both a lack of time and room for teachers to use their judgement when delivering their own maths curriculum. There is a perceived lack of space and therefore SMA, when included, feels like an extra that has been crammed in. The current system does not allow teachers to take the time that they would like to explore social justice issues through maths, despite seeing this as valuable. On top of this, a lack of time was a clear theme throughout the interviews despite a clear passion to include more social justice within their maths lessons.

### **Increases in Student Engagement and SMA**

Another theme that emerged was that the children benefited from the social justice lessons in terms of increased engagement and development of SMA. The TRs noted opportunities for collaboration, pupil voice, to push the greater depth children to expand their understanding with critical thinking, as they were able to organise their thoughts in a different way and see things from another angle.

Many studies have shown the benefits, especially in relation to engagement, of linking maths with the children's world outside of the classroom. The students in Baird et al.'s (2020) study believed that the cultural connections to their own lives increased their motivation levels. Hidi & Harackiewicz (2000) argue that if a student perceives a problem as meaningful, then it is much more likely to hold their interest. This was certainly the case in our study. There was consensus that the social justice element of the lesson improved engagement:

I found all the children were really engaged and were really passionate about putting forward why their idea was the strongest. (David, Meeting 5)

I think, by presenting maths in a different way, I've had less of a "I don't want to do this, this is boring" reaction, and then seeing "actually, this is maths used in a different context". (Rose, Interview 2)

The real-world context gave the children a chance to apply maths to and have a say on real-life issues. This cultivated the children's SMA. The project was able to change some of the children's attitudes towards maths:

I think in year one, maths is very much... it's in the classroom, it's in the maths lesson.

They're quite specific about that. And they were starting to see, actually, how we can use maths, how we can use numbers in different ways. (Kate, Meeting 3)

Making links to the students' world is an individualised skill that cannot be mass-produced. Teacher judgement in planning and delivering is absolutely key here and to miss this opportunity is to miss the chance to help students to connect their learning to their lives.

This hook allowed some children who struggle with maths to see themselves as mathematicians:

They could see how maths then translates into their... real lives. And they could see, yes, they are mathematicians, they just didn't realise it. (Kate, Meeting 5)

The use of teacher judgement allowed for more meaningful and purposeful maths lessons for the children:

Quite a lot of the children had that assumption, you know, that maths was just for answering questions in school. And I've tried to reiterate in every lesson... where the benefits of this type of learning will help in the real-world. (Aidan, Meeting 3)

The TRs shared the positive impact of the social justice lessons:

I think it's had a really positive impact on the students and in how their understanding of mathematics and the importance of mathematics, not just in the context of a maths lesson, but in the wider world. (Aidan, Interview 2)

However, one TR noted:

I don't think the children realise quite the impact it's had, but I can see that it's had a real impact. They just sit there like "Oh, we're using maths for something else". And now you can see that they are more inclined to, sort of, vote on things and, sort of, suggest that sort of thing. (Kate, Interview 2)

In this case, the positive impact is clear to the TR but not to the students and thus there is more work to be done if all of the benefits are to be extracted and utilised.

## **Opportunities for Professional Development**

The TRs were overwhelmingly positive about the method (PAR) and being able to collaborate with other teachers:

When we brainstorm together, as well, you come up with much stronger ideas... when you're working with another individual, it... just expands, obviously, your range of thoughts and ideas and directions that you might go in. And hopefully, you know, you complement each other as well... I'm not sure it would have been as strong if I'd have been doing it on my own. (David, Meeting 5)

The TRs valued the opportunities for professional development and reflection. They clearly valued the opportunities created by PAR to explore, reflect and improve their practice:

It has been rewarding, I think we've all seen, and got some real benefit from it. It just needs to be seen as how it can be integrated and fitted in potentially with the maths programme that you've got. (David, Meeting 5)

This was heightened further by the opportunities to plan and reflect with other teachers:

The collaboration with other teachers... I've seen how beneficial it is. It's been interesting to do it across two schools, because you get different ideas, and you pick up on different techniques and strategies. (Rose, Interview 2)

There was consensus amongst TRs that the project has had a positive impact on their thinking and practice:

I think it's got me to think how can I include collaboration a little bit more in the lessons and, kind of, draw out the problem-solving aspect of maths... We have a very set way of teaching maths. But it's definitely in my approach to... the delivery of the lessons and the way I ask the students, and the way we interact with the maths on the board, that has perhaps changed. (Rose, Interview 2)

So, yes, it's definitely... improved my own maths teaching. (Aidan, Interview 2)

## **Summary**

There was a higher level of engagement and participation from the students in comparison to their normal maths lessons. Students became more enthusiastic in solving real-life mathematical problems when these drew on contexts that were meaningful to them. The impact of this was an enhanced understanding of both mathematics and social justice issues for the students involved. The TRs were impressed with the extent to which students embraced the opportunity to use maths to enact change. The students entered mathematical discussions passionately and enthusiastically. The TRs observed their students using maths to support their thoughts in the lessons. They also noticed increased engagement from the students, especially when they found out that their arguments would be listened to.

Teachers noted the constraints of the curriculum and jam-packed schemes prevent SMA from taking place meaningfully. They began to consider alternatives so that they could include social justice as they could see its benefits. TRs also noted the benefits of reflecting and gaining professional development through this project. The interviews echoed a clear, positive theme of TRs broadening their perspectives on practice. The use of PAR facilitated this journey well, as it offered plenty of opportunities for reflection and discussion. It allowed the teachers to create space for SMA and helped them to feel supported whilst trying it out for the first time.

As clear steps forward have been made with both the TRs and students of the two schools, it may well be worth doing follow up work with these teachers to take student engagement to the next level. As children in the school are now familiar with SMA, the children could choose their own issues to

tackle (either from a list or from their own lives). One TR said that this worked well with her year 6 class. In another case, the children worked on a new rota to make the use of playground areas fairer. This was given to SLT to consider and the TR reported that the children had a very positive reaction to the potential changes that they could enact. It would be useful to record the children's thoughts on their involvement in the PSMJ project.

## References

- Andersson, A., & Valero, P. (2016). Negotiating critical pedagogical discourses: Stories of contexts, mathematics, and agency. In P. Ernest & B. Sriraman (Eds.), *Critical Mathematics Education: Theory, Praxis and Reality* (pp. 119–226). Information Age Publishing.
- Baird A. S., Garrett R., & August, D. (2020). Math and English language development: MELDing content and academic language for English learners. *NABE Journal of Research and Practice*, 10(1), 1–12. <https://doi.org/10.1080/26390043.2019.1653051>
- Ball, S. J. (2003). The teacher's soul and the terrors of performativity. *Journal of Education Policy*, 18, 215–228. <https://doi.org/10.1080/0268093022000043065>
- Biesta, G. (2015). What is education for? On good education, teacher judgement, and educational professionalism. *European Journal of Education*, 50, 75–87. <https://doi.org/10.1111/ejed.12109>
- Braun, V., & Clarke, V. (2022). *Thematic analysis: A practical guide*. SAGE.
- Cowie, M., Taylor, D. & Croxford, L. (2007). 'Tough, intelligent accountability' in Scottish secondary schools and the role of Standard Tables and Charts (STACS): A critical appraisal. *Scottish Educational Review*, 39, 29–50. <https://doi.org/10.1163/27730840-03901004>
- Gutstein, E. (2006). *Reading and writing the world with mathematics: Toward a pedagogy for social justice*. Routledge.
- Hidi, S., & Harackiewicz, J. M. (2000). Motivating the academically unmotivated: A critical issue for the 21st Century. *Review of Educational Research*, 70(2), 151–179. <https://doi.org/10.3102/00346543070002151>
- Leander, K. M. & Osborne, M. D. (2008). Complex positioning: Teachers as agents of curricular and pedagogical reform. *Journal of Curriculum Studies*, 40, 23–46. <https://doi.org/10.1080/00220270601089199>
- Leat, D. (2014). Curriculum regulation in England: Giving with one hand and taking away with the other. *European Journal of Curriculum Studies*, 1, 69–74.
- Manyukhina, Y., & Wyse, D. (2019). Learner agency and the curriculum: A critical realist perspective. *The Curriculum Journal*, 30(3), 223–243. <https://doi.org/10.1080/09585176.2019.1599973>
- McNiff, J. (2013). *Action research: Principles and practice*. Taylor & Francis Group.
- Nygreen, K. (2009). Critical dilemmas in PAR: Toward a new theory of engaged research for social change. *Social Justice*, 36(4), 14–35.

- Pyhältö, K., Pietarinen, J., & Soini, T. (2014). Comprehensive school teachers' professional agency in large-scale educational change. *Journal of Educational Change*, 15, 303–325. <https://doi.org/10.1007/s10833-013-9215-8>
- Schoenfeld, A. (2012). Problematizing the didactic triangle. *ZDM Mathematics Education*, 44(5), 587–599. <https://doi.org/10.1007/s11858-012-0395-0>
- Skovsmose, O. (2011). *An invitation to critical mathematics education*. Sense Publishers.
- Skovsmose, O., & Borba, M. (2004). Research methodology and critical mathematics education. In P. Valero & R. Zevenbergen (Eds.), *Researching the socio-political dimensions of mathematics education* (pp. 207–226). Kluwer Academic Publishers.
- Wiedeman, C. R. (2002). Teacher preparation, social justice, equity: A review of the literature. *Equity & Excellence in Education*, 35(3), 200–211. <https://doi.org/10.1080/713845323>
- Williams J. (2020). 'Mastery mathematics' – but who is the slave? *FORUM*, 62(1), 65–68. <https://doi.org/10.15730/forum.2020.62.1.65>
- Wright, P. (2016). *Teaching mathematics for social justice: Meaningful projects for the secondary mathematics classroom*. Association of Teachers of Mathematics.
- Wright, P. (2017). Critical relationships between teachers and learners of school mathematics. *Pedagogy, Culture and Society*, 25(4), 515–530. <https://doi.org/10.1080/14681366.2017.1285345>
- Wright, P. (2021). Transforming mathematics classroom practice through participatory action research. *Journal of Mathematics Teacher Education*, 24(2), 155–177. <https://doi.org/10.1007/s10857-019-09452-1>
- Wright, P. (2022). Conceptualising and operationalising socio-mathematical agency. *Proceedings of the Twelfth Congress of the European Society for Research in Mathematics Education (CERME)*, Bozen-Bolzano, Italy.
- Wright, P., Hilton, C., & Kelly, J. (2023). *Primary Maths and Social Justice research project report*. Retrieved from <https://mathsocialjustice.files.wordpress.com/2023/01/pmsj-report-jan23.pdf>
- Yasukawa, K., Skovsmose, O., & Ravn, O. (2016). Scripting the world in mathematics and its ethical implications. In P. Ernest, B. Sriraman, & N. Ernest (Eds.), *Critical mathematics education: Theory, practice and reality* (pp. 81–98). Information Age Publishing.