Primary mastery specialism: from training to the classroom

Jennifer Shearman[1], Vivien Townsend[1], Alf Coles[2], Chris Dale[1]

National Centre for Excellence in the Teaching of Mathematics[1], University of Bristol[2]

We are engaged in an on-going project to evaluate the impact of Primary Teaching for Mastery Specialist training, on the teachers who attend and also on their students. We aim to understand more about how messages around Mastery are understood by teachers, how they are operationalized in their classrooms, and any impact on students and on those teachers' facilitation of groups of teachers in their own schools. We draw on Prediger's "three tetrahedron model" of professional development, to conceptualise the complex relationships between the activities taking place during Mastery training and the activities taking place in teachers' lessons. We offer a snapshot of our data: a key theme from the first residential training was teachers' concerns for "fidelity" and we illustrate three different interpretations of what this means.

Keywords: primary mathematics; mastery; professional development

Introduction

In this article, we offer a small-scale evaluation of Teaching for Mastery (TfM). Teaching for Mastery is a pedagogical approach based on 'Five Big Ideas' (NCETM, 2017) that aims to give pupils of all ages a deep, long-term, secure and adaptable understanding of mathematics. TfM is fully-funded by the Department of Education (DfE) and increasing the reach of mastery in schools has been government policy since 2014, when the NCETM was awarded £40 million to spread the approach to thousands of primary schools via a network of (now) 40 'Maths Hubs' (DfE, 2016).

There has not yet been an independent evaluation of TfM. Small scale studies (e.g., Coles & Helme, 2022) and anecdotal evidence indicate the training and support provided by NCETM is, in some cases, having a transformative effect in schools. The NCETM's internal evaluation reports find TfM Work Groups improve pupils' attitudes and understanding, and this effect grows with schools' continual involvement (Shearman, 2023). Randomised control trials of other Mastery approaches to primary mathematics have suggested small but positive effect sizes (Jerrim & Vignoles, 2015). However, a report on the implementation of Mastery in England concluded there is a lack of evaluation of reforms (Blausten, et al, 2020).

We report here from the 2023-24 academic year, corresponding to the tenth year of the Maths Hubs programme and the ninth year of TfM, when the University of Bristol and the NCETM jointly researched how TfM changes teacher knowledge and practice from the perspective of seven training Primary TfM Specialists. The research was a collaboration between policymakers, researchers, and school leaders; a bipartite relationship between mastery teaching and mastery research; and synthesising different types of impact evidence. Working together facilitated access to trainers, teachers and classrooms in an academically rigorous professional environment. In the next section we review some literature around TfM, before moving into details of our empirical study and concluding with implications for the future.

Teaching for Mastery

The NCETM and the Maths Hubs' version of TfM was instigated by historic findings that over 20% of 15-year-olds in England did not reach levels of numeracy deemed necessary to function in a technological society (OECD, 2012) and a Department for Education (DfE) curriculum review in the same year which compared the then English mathematics curriculum to higher performing countries. A decision to base TfM on the approaches to mathematics teaching in Shanghai was made following an exploratory visit to the country in 2014.

The phrase 'Teaching for Mastery' referred to in this paper relates to a set of principles and strategies for teaching and learning mathematics advocated by the NCETM and the Maths Hubs. Separate from the DfE funded mastery initiative, other education providers offering mathematics mastery programmes include Ark Schools' Mathematics Mastery programme, La Salle Education's Mastery in Mathematics, Maths No Problem!'s Teaching Maths for Mastery and self-titled programmes by Inspire Maths and White Rose Maths.

TfM is built on the premise that all children can learn and enjoy mathematics if the mathematics curriculum is planned and taught for a coherent, manner and pupils focus and engage fully as learners who reason and seek to make connections (NCETM, 2022). Each of the 'Five Big Ideas' (NCETM, 2017) represent pedagogical choices it is suggested teachers should make, to support curriculum and teaching: (*Coherence* of the learning progression through the curriculum; *Representation and Structure* of key mathematical concepts; *Mathematical Thinking* eg looking for patterns and relationships; *Fluency* in efficiently and accurately recalling key number facts and procedures; *Variation* as a teaching strategy that draws pupils' attention to a key feature of a mathematical concept or structure). The Five Big Ideas assimilate collective knowledge of good practice approaches to teaching mathematics drawn from relevant research literature. The connections between these elements of good practice and the Five Big Ideas have been categorised in different ways (eg Boylan, et al, 2019; Shearman, 2021).

TfM professional development programmes assume that the approach can be sustained in schools if teachers continually develop their specialist knowledge for teaching mathematics and work collaboratively to refine and improve their teaching. This development depends on the availability and expertise of Primary TfM Specialists: expert practicing classroom teachers and Local Leaders of Maths Education (LLMEs). Primary TfM Specialists lead mastery professional development across the country; after a year's intensive training in the principles of TfM and professional development leadership, Primary TfM Specialists extend TfM in their own schools and share the approach with neighbouring schools by leading TfM Work Groups. In 2023-24 the Cohort 9 Primary TfM Specialists began their training.

The importance of these specialists in the success of TfM lends weight to the argument that the mechanisms and impact of this training should be researched and evaluated, hence this research project. However, there are constraints on the NCETM's capacity to commission external evaluation within its current funding model. In general, the "contextual, local, situated nature of teaching and learning" results in limited experimental conceptualisations of research into teacher education (Borko, et al, 2008, p.4). Research into teacher education needs to be pluralistic in methods and conducted rigorously if it is to inform wise policy (ibid). It is hoped that collaborative research between the NCETM and a University can be one such example.

Our research questions were: (1) How does the Primary Teaching for Mastery Specialist training equip teachers for their ongoing role?; (2) How do individual Primary Teaching for Mastery Specialist teachers implement TfM and how does their approach change over time?; (3) What are the views of Primary Teaching for Mastery Specialist teachers on teaching and learning mathematics, and how do these views change over time?

Methodology

Given the resources available, we worked with a small cohort of teachers (3 teachers in two Hubs) and hence our project is a qualitative inquiry. We are looking for sensitising concepts (Blumer, 1954) which, rather than offer "prescriptions of what to see [...] suggest directions along which to look" (p.7). We are investigating a complex phenomenon, involving students and teachers in classrooms, teachers in professional development settings working on their teaching and teachers in professional development settings learning about facilitating other teachers. To help us navigate this complexity, we have drawn on Prediger et al.'s (2019) framing of professional development (see Figure 1). There are some key terms which need a little explanation. Resources include digital technologies, electronic or paper resources such as tasks and artifacts (e.g., student or teacher solutions to a task). It is often the case that resources traverse across levels relatively easily. For example, a task done with teachers on a PD course (Teacher PD level) might be suitable to be used with students (Classroom level).

Teacher PD content means those aspects of teaching and learning which are addressed on a PD course. Facilitator PD content means those aspects of facilitating the work of mathematics teachers which are addressed on a PD course. This might include issues such as "managing discussion" which would inform a teacher/facilitator's work with other teachers but would not likely become a focus of the Teacher PD content.

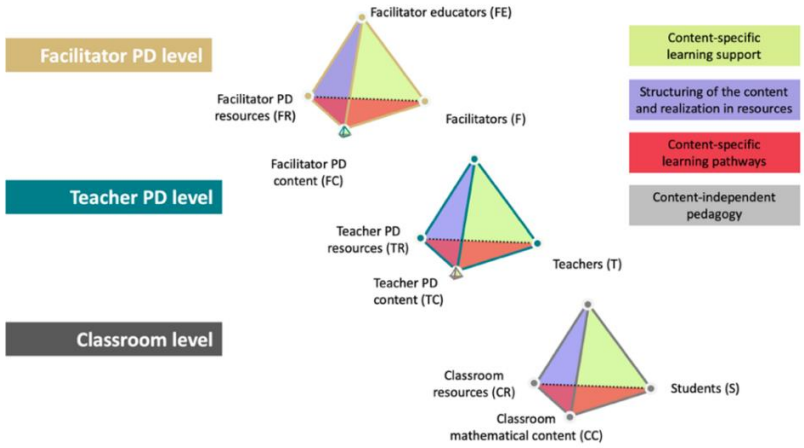

Figure 1: Prediger et al.'s (2019) three tetrahedron model

As Prediger et al. (2019) note, one affordance of the model (Figure 1) is that it allows a focus on the nodes, on the edges and also the faces. It prompts questions about the parallels across the levels of the system. Prediger et al. (2019) articulate what comes into focus on each face in the key on the right-hand side of Figure 1.

The Primary TfM Specialist training is perhaps unusual in moving between Teacher PD and Facilitator PD levels. The model has helped us be attuned to these moves and has become one of the mechanisms through which we approach our research questions. Looking at the data from the first two residentials and the first visit in schools the research team initially aimed to identify themes, i.e., patterns in the things teachers

spoke about. There is always a decision about the level of generality at which to label a theme. The initial list of themes was: 1. Interactive whole-class teaching; 2. Meeting the needs of all learners; 3. Sequencing of learning – coherence; 4. Facts and fluency; 5. Mathematical thinking and reasoning; 6. Variation; 7. Representation and structure; 8. Teacher subject knowledge; 9. Use of resources; 10. Fidelity; 11. Working and learning with others. These themes are numbered simply in the order they arose. In this paper, we focus on theme 10, Fidelity, as this was one that seemed to be around for all of the teachers. We move to our findings across three teachers from one Hub as these were the teachers where we had the most complete dataset.

Findings

The three teachers are Charlotte, Amanda and Liam. Charlotte works in a primary school as the schools' maths subject leader and Year 3 teacher. Her school has been part of the Primary TfM Pathway since 2021. She described herself as being passionate about TfM. Charlotte is using the NCETM Curriculum Prioritisation materials in her classroom – as advocated by the programme leaders in the residentials – and has introduced these across her school. Amanda works in a small school where she holds multiple roles including those of maths subject leader, deputy head teacher and reception teacher. She had been involved with her local maths hub for six years, and her school joined the Primary TfM Pathway in 2019. Liam's school joined the Primary TfM Pathway in 2018, and he has been involved for all of this time. He is the maths subject leader and Year 6 teacher in a one-form entry primary school. He is teaching in the context that Charlotte asked to be removed from, and the pressures of SATs have an inevitable impact on how Liam experiences the specialist training. They are engaging with fidelity to TfM in different ways according to their professional and school contexts. We look across their data to draw out our initial findings, space only allows us to summarise from their words.

Fidelity to TfM in their own teaching – the Classroom level

All three trainee specialists describe learning about mathematics teaching and the five big ideas of TfM from "the Gods", and that this is having an impact on their own teaching. Charlotte follows the Curriculum Prioritisation materials and has asked to work in Year 3 so that the core pedagogies of TfM can be embedded with fidelity in her practice; in this sense, she is a model specialist. Amanda and Liam, working at the extremes of the primary phase experience tensions, as other pedagogies are already embedded: Amanda is grappling with adopting TfM alongside Early Years pedagogies such as play-based learning, while Liam is engaging with some approaches for the first time in the context of teaching in Year 6.

Fidelity to leading TfM across their school – the Teacher PD level

Again, all three trainee specialists refer to their schools, and the need for school-wide approaches that have fidelity to TfM. Although Charlotte's school has worked with the maths hub for the shortest time, she already seems to have done the work of ensuring consistency across her school, in part through the adoption of the Curriculum Prioritisation materials. This is further evidence of how Charlotte has prepared herself – and her school – for her future role as a specialist. Liam talks about how the school has a commitment to TfM because it is "a good cause for helping our students be better maths students". The specialist training opens Liam's eyes to what fidelity to TfM looks

like and clarifies what he might expect to see in different year groups. Amanda makes significant reflections about the challenges of engaging others in engaging with TfM and is aware of the impact that context makes to teachers' capacity to take on new ideas.

Fidelity to leading TfM as a specialist – the Facilitator PD level

In different ways, Charlotte, Amanda and Liam are preparing for their future role as a leader of professional development. While Amanda and Liam speak less about how they have been prepared for the role of leading PD, this is a large part of Charlotte's learning. Charlotte's preparation for the training year has been about ensuring that she is able to do a good job when she becomes a fully-fledged specialist. Taking advice from a colleague in the role already, she has ensured that structures and systems are in place in her own school. She has overtly reflected on how she has learned about programme facilitation from being part of the training; approaches that she intends to adopt in her future work. She is aiming to lead professional development with fidelity to what she has experienced from "the Gods".

Conclusion

The data presented from this ongoing research offer interesting evidence about how three Primary TfM Specialists develop their knowledge of TfM and its pedagogical implications.

Firstly, the existing knowledge and context the three teachers brought to the start of their training is associated with different reflections about mastery at Classroom level. Amanda, the experienced Year R teacher, subject lead, and deputy head teacher, deeply considered how TfM aligned with other pedagogies for teaching young children. Liam, the less experienced Year 6 teacher, embraced the subject knowledge development aspect of the residentials but was concerned about balancing the mastery approach with preparedness for SATs examinations.

Secondly, and related to the above point, having a good understanding of the role of a Primary TfM Specialist before the programme could smooth out some of these wider challenges. Charlotte, who had thought the most about the implications for 'being a TfM Specialist', had put herself in the least complex position to engage with training: she requested to teach a Year 3 class, ensured she had the support of Senior Leadership and a strategy for colleagues to cover her during her absences.

Some of the tensions about TfM at the Classroom level are seemingly not experienced at the PD level (Figure 1), where all three teachers seem to have relatively closely aligned concerns for fidelity and adapting to the reality of their school contexts. At the Facilitator level, differences again emerge, with the two teachers who experience most tensions seemingly less focused on this level (and their upcoming role).

The process of following the three teachers through a set of residentials are offering insights about how the nature of the training equips teachers for their ongoing role. The residentials were designed to challenge previous thinking about mathematics and how to teach it: all three of the research participants found the level of challenge overwhelming to start with but grew more 'comfortable with being uncomfortable' as the year progressed. The NCETM Primary Director and Assistant Director, who led the residentials, spoke with reverence about how TfM developed from Shanghai, and this inspires the teachers to consider they are 'learning from the Gods'. While there may be

dangers in assuming an external authority has 'the answers' to the complexity of teaching, equally, the admiration of facilitators seems part of why the participants want to commit to leading TfM with fidelity: they know it will be challenging but are presented with evidence that the inevitable struggles and compromises will lead to enhanced pupil understanding and achievement.

References

Blausten, H., Gyngell, C., Aichmayr, H., & Spengler, N. (2020). Supporting mathematics teaching for mastery in England. In *Empowering Teachers to Build a Better World* (pp. 29-49). Springer, Singapore.

Borko, H., Liston, D., & Whitcomb, J. A. (2007). Genres of empirical research in teacher education. *Journal of teacher education*, *58*(1), 3-11.

Boylan, M., Wolstenholme, C., Demack, S., Maxwell, B., Jay, T., Adams, G. and Reaney, S. (2019) *Longitudinal evaluation of the Mathematics Teacher Exchange: China-England - Final Report*. Department for Education. Available at: www.gov.uk/government/publications (Accessed: June 2024).

Blumer, H. (1954). What's wrong with social theory. *American Socio-logical Review, 19*(1), 3–10.

Coles, A., & Helme, R. (2022). Teaching for mastery in primary mathematics: A study of translating research into policy and practice. *Review of Education*, *10*(1). https://doi.org/10.1002/rev3.3326

DfE (2016) *South Asian method of teaching maths to be rolled out in schools*. London: HM stationery office. Available at: https://www.gov.uk/government/news/south-asian-method-of-teaching-maths-to-be-rolled-out-in-schools (Accessed: June 2024).

Jerrim, J., & Vignoles, A. (2015). Mathematics Mastery: Overarching Summary Report. *Education Endowment Foundation*. Available at: https://files.eric.ed.gov/fulltext/ED581180.pdf (Accessed: June 2024)

NCETM (2017) *Five Big Ideas in Teaching for Mastery*, available at https://www.ncetm.org.uk/teaching-for-mastery/mastery-explained/five-big-ideas-in-teaching-for-mastery/ (Accessed June 2024)

NCETM (2022). *The Essence of Mathematics Teaching for Mastery,* available at https://www.ncetm.org.uk/teaching-for-mastery/mastery-explained/the-essence-of-mathematics-teaching-for-mastery/ (Accessed June 2024)

OECD. (2012). *Programme for International Student Assessment (PISA)—Results from PISA 2012*, OCED Publishing, Paris. Available at https://www.oecd.org/pisa/keyfindings/PISA-2012-results-UK.pdf (Accessed June 2024)

Prediger, S., Roesken-Winter, B. & Leuders, T. (2019). Which research can support PD facilitators? Strategies for content-related PD research in the Three-Tetrahedron Model. *Journal of Mathematics Teacher Education, 22*, 407–425.

Shearman, J. (2021). 'Multiple meanings of mastery in mathematics education: a Q methodology study.' *EdD Thesis* Canterbury Christ Church University. Available at: https://repository.canterbury.ac.uk/item/91186/multiple-meanings-of-mastery-in-mathematics-education-a-q-methodology-study (Accessed: June 2024)

Shearman, J. (2023). From teachers to schools: a reflection on an evolved approach to evaluation and impact 2019-23, *NCETM internal report to Maths Hub Strategic Boards.*