Embedding Teaching for Mastery in Secondary Schools

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This paper draws from a wider research project exploring Teaching for Mastery in secondary schools in England. The research aims to understand more about how Teaching for Mastery becomes embedded within mathematics departments and school networks. Here we report some initial findings and emerging themes from school visits, interviews, pupil voice and observations across four secondary schools. We examine how the Teaching for Mastery approach is understood by mathematics teachers and senior school leaders; how teachers utilise the mastery approach in their classroom practice; the role and impact of Maths Hubs; and how Teaching for Mastery reaches beyond the Mastery Specialist. The successes and challenges experienced by teachers and schools are discussed, and we identify the conditions which enable embedding Teaching for Mastery in secondary schools, reflecting on how implementation can be facilitated.

Keywords: mastery; professional development; collaboration; secondary mathematics

Introduction

The National Centre for Excellence in the Teaching of Mathematics (NCETM), funded by the Department for Education, has been instrumental in leading mathematics education change in English schools. Central to this drive for improvement has been the Teaching for Mastery (TfM) approach, which promotes a deep, connected understanding of mathematics, and in 2014, the NCETM launched the Maths Hubs Programme, a national initiative to enable teachers and schools to develop and share excellent mathematics education practice (NCETM, 2014). This paper presents some initial findings and reflections from a broader research project exploring how TfM becomes embedded within a secondary school context. Specifically, we seek to identify the conditions that enable the implementation and we consider the role of Maths Hubs in facilitating educators and the wider system structures.

Teaching for Mastery

It is important to highlight the contextual significance of this study within England. Over the last decade, there has been the introduction of a 'knowledge-rich' National Curriculum (DfE, 2013; Gibb, 2021), and this has brought with it a drive to develop curriculum reform. One of the major reforms that has been on-going since 2014 in England is the introduction of Teaching for Mastery in mathematics education. In essence, Teaching for Mastery builds on previous uses of the term *mastery* (e.g., Block & Anderson, 1975) and attests that all pupils are capable of learning school maths and that teaching should adopt approaches that enable this to happen (NCETM, 2017, 2022). Because of this, many teachers across England are engaged in government

funded professional development where specific teaching practices are promoted. Five pedagogical ideas known as the 'Five Big Ideas' (NCETM, 2017) form the basis of this curriculum reform: use of representation and structure, development of mathematical thinking, mathematical fluency, use of variation theory, and curriculum coherence.

Although the Five Big Ideas are presented as one collection of pedagogical ideas, each one is built upon a broad range of research literature individually. The first of the Five Big Ideas - the use of multiple representations - is based on the notion teachers should use a variety of representations in order to support student learning (Goldin and Shteingold, 2001; Duval, 2006; Rau and Matthews, 2017). Within the TfM approach, teachers are encouraged to use a variety of representations and manipulatives in a precise and coherent way, so as to help students engage with mathematical structure (NCETM, 2017). The second Big Idea - mathematical thinking - includes "looking for patterns and relationships, making connections, conjecturing, reasoning, and generalising" (NCETM, 2017) and, as with the first Big Idea, is widely considered to be a fundamental part of mathematics education and many have developed models to explain the different aspects of mathematical thinking (e.g. NRC, 2001). Similarly, the third Big Idea - mathematical fluency - is a widely researched area, with some focussing on specific aspects such as *number sense* (Gray and Tall, 1994) and others producing a more general framework for fluency (e.g. Van de Walle et al, 2020). Fluency includes recall of key facts, flexibility with method and representation, and appropriate choice of approach to calculation (NCETM, 2017). The fourth Big Idea - variation theory - is a relatively new concept within English mathematics education, but has a long standing tradition within mathematics teaching in East Asian countries such as China and Japan (Huang and Li, 2017). Variation includes how representations are used as well as the sequence of learning and is referred to as "varying some elements, while keeping others constant" (NCETM, 2017), so as to highlight key mathematical features to pupils. Finally, the fifth Big Idea - coherence – a complex concept (Peters, 2024) which can be seen as an overarching idea encompassing the first four Big Ideas. Pupils need to experience a coherent journey of mathematics, including small steps within a lesson as well as long-term curriculum sequencing of concepts.

Maths Hubs and Secondary Mathematics Specialists

All state schools in England are served by one of the 40 Maths Hubs and a key aspect in the implementation of TfM has been the Maths Hub-led development programme for Secondary Mastery Specialists (SMS). This programme aims to support the development of experienced teachers to implement mastery approaches in their own classrooms and lead professional development within and beyond their schools, supporting system-wide improvement in mathematics education. As of the academic year 2024-25, Maths Hubs have recruited and trained nine annual cohorts of SMSs.

Research Questions

The research presented in this paper is the work of four Maths Hubs with the aim to identify strategies to improve the impact of having a SMS based in a school. To achieve this, the focus of the research was to understand the factors which afford department wide change within a secondary school.

The research aimed to explore the process of embedding TfM in secondary schools where there is a SMS. Our wider research questions were: What are the conditions necessary for TfM to be embedded in a mathematics department? What barriers prevent this and how are they overcome?

Methodology

The aim of the research was to deepen our understanding of the processes and conditions which enable the widespread use of a TfM approach in an English secondary school mathematics department. This is a complex phenomenon; therefore we employed a multiple case study approach (Stake, 1995, 2006; Thomas, 2021) in four mathematics departments. Each of the four secondary schools were located in different Maths Hubs across England and each school was selected based on a SMS working there who had held the position for over two years. During the 2024-25 academic year the research team visited each of the schools to observe lessons, interview school leaders and department staff, and conduct focus groups with pupils. The data collection focused on the teachers' and leaders' understanding of TfM, teacher engagement with Maths Hubs, TfM in classroom practice, and pupils' experiences and views of learning mathematics. For analysis, our first stage occurred at a local level, understanding the phenomenon within each school, followed by a second stage with a broader lens, eliciting overarching themes drawn from all four schools.

Some initial findings

Following each visit the research team considered how Teaching for Mastery was evident in the school and the processes by which this had occurred.

In **School A**, teachers reported that collaboration was often pursued in their own time rather than through structured departmental time, which was limited and contributed to a lack of coherence in TfM practices across the department. Department leadership was characterised by a strong culture of autonomy and trust, which teachers found both empowering and challenging as it allowed individual innovation but also resulted in inconsistency in pedagogy and classroom experience. While the essence of TfM was reflected in shared beliefs about effective teaching, we noted a lack of common language or consistent implementation.

Teachers in **School B** often engaged with the local Maths Hub, which was seen as a key driver for individual professional development and department wide teaching practices. Individual teacher engagement with TfM was evident in observed lessons and interviews, and there was a dedicated hour of professional development each week. Leadership within the department had a clear structure where the SMS acted as a scholarly influence and the Head of Mathematics provided strategic direction and support. There was a consistent understanding of TfM across the department, with evidence of variation, representation, and coherence in the observed lessons, and the pupils articulated a purpose and enjoyment in studying mathematics.

At **School C**, teacher collaboration was highly valued, and teachers spoke passionately about previous opportunities they had to regularly meet as a department during the school day, leading to effective and meaningful collaboration. In contrast, current opportunities were limited to brief, infrequent department meetings - just 25 minutes every eight weeks. Although these times were informed by staff who had participated in external training and Maths Hub activities, they predominantly focused on sharing lesson resources rather than pedagogical discussions about mathematics. Leadership was shared between the Head of Mathematics and the SMS, who aligned closely in their vision for teaching and learning, using learning walks and staff development to drive consistency and improvement. We found the understanding of TfM varied among staff and, as with School A, the term *mastery* was rarely used explicitly, though elements of the Five Big Ideas were present in practice.

Leadership support for development in **School D** was evident from the Headteacher - who played an important role in fostering openness to new ideas – down to the Head of Mathematics and the SMS, who provided strategic and pedagogical guidance, leading to a positive and cohesive departmental culture. Department time together was used effectively for collaborative planning and professional development, and teacher understanding of TfM – although inconsistent across the team - was evident in interviews and lessons across the department, with representations and coherent visual modelling observed in lessons.

Discussion

The findings from the four schools illustrate the complexity of implementing Teaching for Mastery in a secondary school. Each mathematics department had a proactive SMS, a supportive Head of Mathematics, other teachers in the department who engaged with Maths Hubs work, and a senior leadership team who understood Teaching for Mastery. However, within each school there were challenges implementing the mastery approach across teaching practice in the department. Our discussion reflects on the main drivers that enable implementation and the challenges faced by mathematics departments.

Leading change

Across all schools, the head of department and senior leaders we interviewed valued the work of Maths Hubs. They understood the mastery approach and spoke highly of the benefits from both a staff and pupil perspective. Yet we saw differences in the extent to which leaders were really driving changes, as led by the SMS, within the school. We found it most effective when leaders provided the space and time for the SMS to share and guide practice with colleagues. Implementing changes within the department resulted from sharing of practice in staff meetings, informed changes to curriculum and policy, and lesson observations of the SMS.

School culture

In all schools, there was collaborative practice within the maths department. However, the extent to which this collaboration led to change in practice was mitigated by the actual type, quality and culture of this collaboration. Where it was working well, the head of department, SMS and colleagues had a deep understanding of what they were trying to achieve, facilitated productive time to work together, and maintained that teachers had some autonomy over how they implemented and experimented in their classrooms. In some cases we found what Hargreaves and Dawe (1990) term ‘contrived collegiality’, where practice, guidance, support and ideas were shared but there was little in the way of precise and focused collaborative work.

Teaching for Mastery in theory and practice

In each school the teachers articulated their understanding about the pedagogical ideas within mastery and there were signs of TfM becoming part of the way the school approaches maths. There were several signs that mastery was becoming embedded, including: How other staff members understood the role of the SMS; senior leader support for teachers engaging in Maths Hub professional development; Maths colleagues knew about TfM and had a developing understanding of what it is. We sometimes found teachers spoke about mastery but did not use the standard language

associated with it, such as the Five Big Ideas; Teachers had a desire to - and a recognition in the value of - engaging in collaborative planning, however this was difficult to implement at a local level without wider leadership decisions; and in some observed lessons teachers were using mastery approaches, such as varied representations, to help pupils engage in more complex mathematical thinking.

Factors that contribute to effective implementation of TfM

Our research found that conditions necessary for implementing mastery in the mathematics classroom involves effective collaboration, an enabling leadership team, and space for experimentation. From this we reflected on how the work of Maths Hubs can influence this process, establishing three fundamental ways in which SMSs can be supported to have an impact in their roles.

First, establishing what effective department level collaboration looks like and the factors that drive this, such as the work of Hargreaves and O'Connor (2018), will help ensure the mechanisms are in place for SMSs to have greater influence. This aligns with the national picture, where schools with historically stronger provision lead professional development at department level (Boylan et al, 2024).

Second, there needs to be a drive and value for this professional development at all levels of school leadership, which is consistent with the findings and recommendations of Perry et al (2024) for enabling professional development. The most senior leaders do not necessarily need to know the 'ins and outs' of teaching for mastery, but they do need to know what the vision is and how this ties together with their own school vision so reform efforts result in adequate time and resources being dedicated to providing opportunities for collaboration and engagement to happen.

Third, there is a difference between talking about TfM and seeing it in real-life. Teachers within the department need numerous opportunities to see what aspects of mastery pedagogy look like in practice, to discuss TfM with each other, and to experiment in their own classrooms (NCETM, 2009). Helping teachers to move from imitating a practice to having it integrated into their ways of teaching is a fundamental step in long term development, which will help mastery to become embedded beyond the SMS's classroom.

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