



Teaching for mastery

**What is happening
in primary maths,
and what next?**



Introduction

This report is a summary of the development and impact of the NCETM/Maths Hubs Primary Teaching for Mastery Programme at the end of the 2018/19 academic year.

It covers:

- the number of schools engaging with the Teaching for Mastery Programme
- the evolution of the individual projects that constitute the Teaching for Mastery Programme
- the impact of the programme on the knowledge and practice of Mastery Specialists and other teachers in the programme
- the impact of the programme on organisational and policy changes within schools
- the impact of the programme on the engagement and achievement of children in mathematics.

Cumulative reach of the Primary Teaching for Mastery Programme (June 2019)

Year	Specialists	Schools
2015/16	136	136
2016/17	283	964
2017/18	465	2567
2018/19	675	5116

In each section, the emerging themes and areas of impact have been highlighted, along with ongoing challenges. The Teaching for Mastery Programme is set to evolve and grow in the future, so an understanding of the areas in which teachers and schools need more support will be used to focus future programme developments.

The programme began in 2015. In the first year, 136 schools from all over England each nominated a teacher to begin training as a Primary Mastery Specialist. The teachers were given a year's intensive training in the principles of teaching for mastery, underpinned by its 'Five Big Ideas', and in professional development leadership. In the following year, they further developed teaching for mastery in their own schools. And they shared the approach with neighbouring schools by leading Teaching for Mastery Work Groups.

In each subsequent year, a new cohort of Primary Mastery Specialists has been trained, increasing the pool of specialists leading Work Groups of local schools. By summer 2019, more than 5,000 schools have participated in the Teaching for Mastery Programme. Hundreds of thousands of children are now benefitting from a changed experience of maths learning at school. The programme is open to all state-funded schools in England.

The research methodology behind this report is summarised on **page 14**.

Executive summary

The research summarised in this report indicates that the NCETM/Maths Hubs Teaching for Mastery Programme is having a significant, positive impact at a number of levels. Teachers are becoming more knowledgeable about, and skilled at, their craft; classroom practice is changing in ways designed to help pupils develop deeper understanding; and there are encouraging signs that pupils are learning maths more securely.

The supporting evidence comes from classroom visits, conversations with school leaders, teaching staff and children, and from examination of Ofsted reports following inspections at schools in the programme.

The introduction includes a brief history of the programme's development so far, and some figures showing how it has grown from its small-scale start in 2015.

Pages 4 and 5 show a primary school's journey through the various stages of implementation of teaching for mastery, and highlight the key role played in the entire programme by the growing nationwide team of Mastery Specialists.

The body of the report (**pages 6 to 13**) analyses the programme's impact through four lenses: teachers' knowledge; teachers' practice; whole-school changes and children's learning.

Subject and pedagogical knowledge development (pages 6–7)

Participating in the programme has made teachers think deeply about mathematical structures and about connections between topics. This has prompted deep thought about how to teach maths. At the same time, teachers have, through experience, recognised the importance of collaborative professional development approaches as a way of bringing about improved learning, both within one school and across a number of schools.

Changes to practice (pages 8–9)

Teachers and researchers are confident that schools on the programme are showing improved classroom practice and lesson design. For example, teachers and children use precise mathematical language and full sentences; speedy recall of number facts is highly valued; and fluency and reasoning are developed in tandem. All pupils are expected to work on the whole curriculum together.

Whole-school changes (pages 10–11)

Leaders of schools on the programme recognise that a whole-school commitment is necessary for teaching for mastery to take root. Among organisational changes found by researchers: early intervention models enabling children to 'keep up, not catch up'; and systems facilitating collaborative lesson design, observation, evaluation and refinement.

Children's engagement and achievement (pages 12–13)

Children are reacting positively to their changed classroom experience. Deeper understanding is evident in a more confident use of correct mathematical language and a more enthusiastic use of reasoning. They value physical and verbal representations of mathematics just as highly as abstract and written ones. Above all, children show a belief that effort can result in everyone achieving success in maths.

Teaching for mastery explained

What's at the heart of teaching for mastery (TfM)? What are the different progression routes?

The key drivers at the heart of the programme are trained **Mastery Specialists**. These are practising teachers, still based and teaching in their own school. By summer 2019, 675 of these specialists have been trained to be expert classroom practitioners themselves, but also to be experts in leading the professional development of teachers in other schools. After a year developing their own teaching practice and helping colleagues in their own school, these Mastery Specialists devote about one day a week to leading a Work Group (also known as a Teacher Research Group, or TRG) of six or seven local schools, as they develop teaching for mastery. And then, the following year, the Mastery Specialists work with another group of schools. This is how mastery has been scaled up across the system, while at the same time ensuring that the programme is rooted in current, school-based evidence and practice.

In addition, every Maths Hub has a trained **Mastery Readiness Lead**, who works with schools needing support during a preparatory year, before participating in the main development phase.

For a summary of how classroom teaching is changing at schools in the programme, see the mastery section of the NCETM website: www.ncetm.org.uk/mastery. The Five Big Ideas are based on the research evidence underpinning teaching for mastery: see www.ncetm.org.uk/fivebigideas.

A school's journey towards mastery

Optional preparatory phase

For schools not yet ready to join the main development phase

Mastery Readiness

Schools are supported by their Maths Hub's Mastery Readiness Lead to strengthen five key areas:

- Vision and culture underpinning maths learning
- Mathematical mindsets
- Subject expertise
- School systems
- Arithmetical proficiency.

Main development phase

All schools complete this phase, which lasts a whole school year

Teaching for Mastery Work Group – led by a Mastery Specialist

These groups are sometimes referred to as TRGs, because they feature some aspects of Teacher Research Groups.

- Two teachers from each of six or seven schools meet every half-term as a group. The meetings involve shared lesson observations and discussion.
- Each school gets a termly bespoke support visit by the Mastery Specialist.
- The group keep in contact and share experiences in between their meetings, creating a whole year of collaborative professional development.
- Funding is available to support teacher release and subsidise investment in DfE-approved textbooks.

First consolidation phase

All schools, more independently, build on previous phase

Schools continue to collaborate in a small group with lighter-touch guidance

- After the main development phase, schools stay in touch with their Work Group colleagues as they begin to embed classroom and school systems practices.
- Lower levels of Maths Hubs funding to subsidise meetings and teacher release.

Further consolidation

Option to join Maths Hubs projects focusing on specific elements of teaching for mastery, such as lesson design, early intervention and mixed-age classes.

How is teaching for mastery helping teachers think about maths and the way they teach it?

Researchers investigated whether, and to what extent, the Teaching for Mastery Programme was improving teachers' subject and pedagogical knowledge. The extent is, inevitably, greater in Mastery Specialists' schools, and so, where appropriate, a distinction is made. Four areas of impact were identified.

1. Teachers report that the professional development is rapidly developing their subject knowledge.

The Mastery Specialist training and the Work Groups are giving teachers a secure understanding of the teaching for mastery principles. All of the teachers reported an improved understanding of mastery, which they describe as a deep understanding of the structure of number and the fundamental concepts in mathematics, and how they are connected. This coherent understanding allows teachers to break down concepts into a series of smaller steps, so they can be made accessible to all children.

▮▮ The growth in my knowledge was exponential. ▮▮

Mastery Specialist, Cohort 1

The programme is giving teachers a deeper knowledge of mathematics beyond a procedural level. Teachers commented that they are thinking about mathematics 'in a different way', including using images, materials and manipulatives to expose underlying structures. This has helped them understand why mathematical misconceptions occur.

The programme is helping teachers understand how mathematical fluency and reasoning develop in tandem. Teachers are using this knowledge to shape schools' development of the curriculum to ensure that children are developing factual knowledge, such as multiplication tables and deep understanding of mathematical concepts. There is also a focus on the development of precise language.

2. Teachers now consider a high level of subject knowledge to be essential. This inspires them to work with colleagues and continue learning beyond the programme.

Observations of teachers on the programme demonstrated their subject expertise and confidence in their teaching approach. Most took part in the programme *because* they wanted to develop their subject knowledge. Teachers stated that the professional development they took part in encouraged them to be critically reflective of themselves and colleagues.

▮▮ Children really need to understand. That means I might need to teach the same lesson again, which may need re-planning and links making to other areas of maths. You have to step back and consider small steps. ▮▮

Maths Lead, 2017/18 Work Group school

3. Teachers understand that an important, and challenging, part of their role involves developing the subject knowledge of colleagues.

Teachers embed teaching for mastery in their own classrooms and year groups first, and this was evident in the schools visited.

▮▮ Working with colleagues to develop their subject knowledge is a huge task but a pivotal one. ▮▮

Subject Lead, 2017/18 Work Group school



4. Teachers are developing their knowledge of effective collaborative professional development within and across schools.

The Teaching for Mastery Programme is giving teachers skills and confidence to make professional decisions that are right for their school in the short, medium and long term.

▮▮ Being part of the Work Group gave me confidence to plan and teach maths differently; every meeting gives me something to bring back to school and share with other staff. ▮▮

Maths Lead, 2017/18 Work Group school

Schools reported that teaching for mastery had challenged professional practices and led to a more collaborative process of lesson design.

Evidence from Ofsted reports

Ofsted identified strong teacher mathematical knowledge and pedagogy in teaching for mastery schools they have visited.

▮▮ Teachers' excellent subject knowledge and their deep understanding of how pupils learn enable them to plan learning tasks exceptionally well. Pupils are given time to master key skills and gain strong knowledge and understanding in subjects taught. As a result, pupils know and remember more. Typically, one pupil said, 'Deliberate practice helps us to ensure that we understand what we do. We choose an amazing challenge that helps us to get the knowledge into our long-term memory'. ▮▮

Ofsted inspection (December 2018) of Langford Primary School, London, which joined the Teaching for Mastery Programme in autumn 2017

Ongoing challenges

Teachers report they are not yet fully confident in the skilful application of variation theory and would like further training in this area. www.ncetm.org.uk/fivebigideas provides a short description of variation theory.

The consistently strong subject knowledge observed in the teachers on the programme had not yet been embedded in all teachers in the schools visited.

How is teaching for mastery changing the teaching of mathematics?

Researchers investigated whether, and how, teaching for mastery was changing classroom practice. Five main characteristics of lessons given by Mastery Specialists and Work Group participants emerged.

1. Teachers adopt strategies to ensure all children access the whole curriculum.

Observers noticed that teachers did not let lower-attaining children experience a narrower range of mathematics. Lessons were observed where teachers sat children in carefully chosen mixed-attainment groups within mixed-attainment classes. All children are expected to achieve key learning points, working independently through the same sequence of work.

“Before [the programme] I did a book scrutiny of Years 1–6. In the topic of data handling, the lower-attainers experienced nothing apart from bar graphs. This had to change.”

Mastery Specialist, Cohort 1

2. Teachers and children emphasise number facts, precise mathematical language and full sentences.

Teachers use stem sentences and talk frames to develop children’s language and reasoning through oral contributions. In some schools, this has spread beyond maths classes and even become a whole-school priority.

“One school now asks all visiting adults to ‘speak in full sentences.’”

Researcher report, 2017/18 Work Group school

3. Lessons develop children’s fluency and reasoning together.

In a school where fluency was previously identified as an area for development, observers noticed the focus on children’s understanding of the structure of number, mathematical laws and focusing on the method as well as the answer. Teachers used concrete and pictorial representations throughout the school, not just in specific years or key stages. But schools also recognised when to withdraw them, to ensure children became confident about working in the abstract.



4. Teachers plan maths lessons by mapping key mathematical concepts in a topic, then breaking them down into small steps.

Teachers are increasingly likely to use a concept mapping and sequencing approach to identify key learning points and ensure that lessons follow a coherent learning journey.

“[Our new approach to] planning has had a great impact.”

Headteacher, 2017/18 Work Group school

Across schools, teachers are spending more time designing mathematics lessons together. They think about the questions that will be used in a lesson, the structure and connections within the mathematics, and ensuring that learning is a coherent series of carefully planned steps.

5. Teachers are adopting and adapting teaching for mastery principles in mixed-age classes.

One teacher mapped the Year 5 and Year 6 curricula, laid them next to each other, and identified areas that would be suitable for whole-class teaching, and areas that needed to be taught separately.

Evidence from Ofsted reports

Ofsted identified that personalised professional development and upskilling of all staff through subject specialists has led to strong progress for students in programme schools they have visited.

“The teaching of mathematics is consistently good across the school. Pupils experience a varied mathematics curriculum which develops their fluency, reasoning and knowledge of how to solve problems.”

Ofsted inspection (October 2018) of Roche Community Primary School, St Austell, Cornwall, which joined the Teaching for Mastery Programme in autumn 2016

Ongoing challenges

Some teachers acknowledge they don’t yet always know the best strategy to balance appropriate support for children who need it, with sufficient depth and challenge for higher-attaining children.

A new approach to lesson planning has meant an inevitable increase in overall planning time. Some teachers are balancing this with less planning for differentiation and time-consuming approaches to evidence gathering and ‘next step’ marking. While this realignment is consistent with the revised Ofsted inspection framework’s emphasis on curriculum quality and revised marking expectations, teachers need support in making the transition.



How is teaching for mastery being embedded in schools?

Central to the Tfm Programme is an expectation that the approaches are embedded in the school, with support of the Senior Leadership Team (SLT). Researchers reported five changes that have emerged.

1. School staff understand that a whole-school commitment is vital to its success.

Headteachers recognise the shift in organisational structure and teacher pedagogy required for implementation. They understand that the relatively short period of high-quality direct support makes it necessary to set up a longer period of teacher-teacher development to ensure sustainability. They recognise the need for significant resourcing and (in some cases) change to policy and curriculum, and they feel this is a worthwhile investment.

“Headteachers need to be trusting and open to change; I am keen to sustain current developments and to make changes at the whole-school structural level.”

Headteacher 2017/18 Work Group school

2. Schools' internal structures have changed through a considered, gradual approach, based on the principle that all children should access the whole maths curriculum.

Schools acknowledge they cannot do everything at once, so are either adopting mastery in one or two year-groups at a time (e.g. starting in Year 1 and Year 3), or one or two mastery principles at a time (e.g. changing to mixed-attainment groups or changing curriculum structure so that fewer topics are studied for longer in each year).

“This is the long game. In the younger years we always keep the class together. But this is even happening in Y6. For example, in the past, [child A] would not have had the same work as everyone else but today she managed it. She demonstrated today that she achieved the same objective as the rest of the class.”

Maths Lead, 2017/18 Work Group school

3. Schools are ensuring their policies support the principle of 'keep up, not catch up'.

Adaptations to assessment policies include utilising immediate verbal feedback and in-class marking. Both these adaptations can reduce teacher workload and help identify children who require intervention. Some schools use lesson or assembly time for same-day intervention; others prefer to pre-teach topics to identified children. Some schools are systematically trialling and monitoring different strategies before deciding on a policy for intervention.

“It is a whole-school target not to let previously identified lower-attaining pupils fall back when other pupils make progress.”

Researcher report on headteacher meeting, 2017/18 Work Group school

4. Schools have adopted a collaborative CPD programme, highlighting it as a vital part of implementing mastery.

The CPD in the schools visited was directly influenced by experiences on the programme. This included aspects such as collaborative planning, non-judgemental lesson observations and feedback, and collective focus on a specific aspect of pedagogy. Staff are expected to take ownership of their own development and of the maths learning in their classes.



“The SLT has created a culture that allows for risk taking on the part of teachers and a willingness to learn from their mistakes and constantly improve.”

Researcher report, 2017/18 Work Group school

Schools use staff meetings and non-contact time for maths-specific CPD. Visiting other schools to watch mastery lessons is valued, and some schools are willing to release teachers to observe learning in other schools, including during the Shanghai exchange.

5. Teaching for mastery pedagogies extend beyond lessons taught by Mastery Specialists or Work Group participants, once their colleagues are confident in their own practice.

Teachers on the programme understand their role in developing others, and give additional support to teachers who need it.

All schools visited demonstrated aspects of teaching for mastery in at least some year groups and are working towards fully embedding it across the school.

“Whole-class focused teaching is used most effectively by teachers who were previously part of Teacher Research Groups.”

Teaching for mastery peer review report, 2019

Evidence from Ofsted reports

In schools visited by Ofsted since beginning the programme, the positive impact teaching for mastery is having on professional development in schools has been noted.

“The leader of mathematics across the trust has provided effective training for teachers and support staff across the school. Consequently, standards in mathematics are rising throughout the school.”

Ofsted inspection (January 2018) of Blackwater Community Primary School, Truro, Cornwall, which joined the Teaching for Mastery Programme in autumn 2017

Ongoing challenges

Schools acknowledge that they haven't yet fully implemented teaching for mastery because existing attainment gaps in some years are, for the moment, too large.

There is not yet a clear understanding of the most effective approaches to support pupils in 'keeping up, not catching up'.

Embedding a teaching for mastery approach is more challenging in schools with a high proportion of inexperienced staff or high staff turnover.

How is teaching for mastery improving children's learning of maths?

The long-term outcome of teacher professional development should be a measurable improvement in children's engagement and achievement. Researchers found four areas of change to children's learning as a direct result of teaching for mastery.

1. Children accept the 'challenge of mathematics' because they are encouraged by the belief that everyone can succeed through effort.

Children articulate a high level of positivity, engagement, enjoyment and enthusiasm for mathematics. Some Key Stage 1 children like 'feeling their brain work'.

Key Stage 2 children particularly engage with mathematics that relates to real-life situations. Children agree that mathematical reasoning can be challenging, but that it is valuable.

/// Attainment is showing some improvement at both Key Stage 1 and Key Stage 2, with a more marked improvement in the progress of lower attainers. There is strong evidence of progress in the children's books, which was also remarked upon by Ofsted. Leaders have noticed considerable improvement in children's ability to articulate their conceptual understanding, indicating a greater depth of learning. ///

Researcher report, 2017/18 Work Group school

2. Children demonstrate their growing understanding of mathematics through their reasoning and willingness to explain their mathematical strategies.

They feel confident, resilient, tenacious, strategic and thoughtful about their mathematical learning.

/// Mathematics is no longer solely about finding answers; it is also about the underlying processes. ///

Headteacher, 2017/18 Work Group school

3. Schools identify the development of mathematical vocabulary and language as having an impact on children's progress.

Children taught using the mastery approach have the means to represent their mathematical reasoning verbally and articulate mathematical statements, including generalisations. This widens access to, and enjoyment of, the maths curriculum by children with EAL or lower levels of literacy.



4. Children recognise that physical and verbal representations of mathematical ideas are as valuable as written ones.

Speaking, listening and responding in mathematics is a consistently high expectation, along with answering questions in complete sentences using precise and accurate mathematical vocabulary. Children demonstrate that they understand the need and purpose of accurate language by building on each other's answers.

Children discuss what helps them learn maths best by relating to specific strategies, such as using physical resources, engaging in group discussions with peers, or teacher explanations that 'break it down into little pieces'.

Evidence from Ofsted reports

Ofsted have identified a link between a teaching for mastery approach and improved learning in mathematics in schools they have visited.

/// Subject leaders have excellent knowledge about their subject areas and work very professionally to support colleagues in developing their own knowledge, skills and understanding. This level of support is particularly strong in mathematics, where ways of working are embedded well in every classroom. Staff continuously reflect upon, and improve, their own practice. As a result, pupils are making very strong progress in mathematics and have very positive attitudes to learning. ///

Ofsted inspection (February 2019) of Danetree Primary School, Epsom, Surrey, which joined the Teaching for Mastery Programme in autumn 2017

Ongoing challenges

Schools report that teaching for mastery is having a positive impact on achievement. However, due to teacher movement within and across schools, and schools' different approaches for rolling out all aspects of mastery, it is too early to attribute changes in Key Stage 1 or Key Stage 2 data to teaching for mastery.

Schools that historically have wide variation in attainment cannot yet adopt a mastery approach in older year groups where the gaps are wide; they acknowledge that it is 'a long game'.

Programme schools with an Ofsted judgement of Requires Improvement (which represent less than 10% of all schools involved in the programme) report that teaching for mastery is making a positive difference to teaching and learning, attainment and progress. More schools in this category may benefit from a teaching for mastery approach.



How did the research team gather evidence for this report?

This report was put together to give interested parties information about teaching for mastery and the effects it has had on teachers and their schools to date.

The research team comprised experienced teachers (including a Maths Hub Lead), Higher Education researchers and independent mathematics consultants, commissioned by the NCETM. They worked with the team of Primary Teaching for Mastery Leads (teachers who work in the Maths Hubs on the programme) who undertook some of the school visits.

The methodology used was theory-based impact evaluation, which was conducted to find out whether research-informed planned change is both happening as planned and having a beneficial effect. The categories of impact were:

- professional learning of teachers about mathematics, pedagogy and leadership
- professional practice, including planning, teaching, assessment, reflection, collaboration and scholarship
- school or department approaches, including practice, policy, vision and culture
- pupil outcomes, including attitudes, engagement, attainment and progress.

The team collected data using multiple methods and identified themes for each outcome.

In November and December 2018, the research team visited:

- eight schools that had a Cohort 1 or 2 Mastery Specialist in post since beginning the programme
- seven schools who had been Work Group Schools in 2016, 2017 or 2018.

In all cases, researchers observed lessons and spoke to teachers and pupils.

The Teaching for Mastery Leads, working in pairs, also visited 13 Work Group schools.

The team also looked at participant surveys from the previous three years, undertook a group exercise with Maths Hub Leads, and read Ofsted reports from schools involved in the programme.

The research team are confident that the report is an accurate description of their observations and analysis. They acknowledge that the non-random sample of school visits can only be indicative of the wider impacts in all schools on the programme.

With thanks to all researchers, Teaching for Mastery Leads, Mastery Specialists, schools participating in Work Groups, NCETM and Maths Hub staff, for their time, energy and expertise in compiling this report. To contact the research team, please email evaluation@ncetm.org.uk.

What next?

This report has provided useful evidence, directly from schools and classrooms, about how teaching for mastery knowledge and practice is being learnt and applied in participant schools. It has reported the effect this is having on children's experiences and achievement in mathematics.

The previous pages have identified strong evidence of practice change and positive impact under four key headings: teacher subject knowledge; classroom practice; school organisational structure and pupil performance. Also noted on those pages, though, are a number of ongoing challenges. This is only to be expected, given that the programme is still in its relatively early stages.

To address those areas, refinements and additions to the programme are underway or planned:

- Continued support for Mastery Specialists and participant schools to ensure they can embed teaching for mastery practices to bring about sustained whole-school change.
- More support for teachers to improve their knowledge and confidence in same-day intervention strategies, and in the application of variation theory.
- Continued development of effective strategies for teachers to design and deliver lessons which ensure all children have access to the whole curriculum with sufficient support, depth and challenge.
- Continued monitoring of the impact of teaching for mastery on the overall attainment and progress of all children, including vulnerable groups, in schools that have been involved with the programme for a number of years.
- Consideration of how best to encourage and support more schools in the Requires Improvement Ofsted category to implement a teaching for mastery approach.

The NCETM's and the Maths Hubs' future plans, which include Mastery Readiness and Embedding Teaching for Mastery Work Groups, aim to address many of these areas. If you would like to know more about the current offer, future plans, or want to get involved, please see www.ncetm.org.uk/mastery or contact your local Maths Hub via www.mathshubs.org.uk/find-your-hub. To contact the research team, please email evaluation@ncetm.org.uk.

Report date: July 2019



Would your school like to join in?

If you or your school would like to participate in the Primary Teaching for Mastery Programme, contact your local Maths Hub via www.mathshubs.org.uk/find-your-hub.