Education
Endowment
Foundation

Mathematics Mastery

Overarching Summary Report

February 2015

Independent evaluators:

John Jerrim
Anna Vignoles

Leading education
and social research

Institute of Education
University of London

The Education Endowment Foundation (EEF)

The Education Endowment Foundation (EEF) is an independent grant-making charity dedicated to breaking the link between family income and educational achievement, ensuring that children from all backgrounds can fulfil their potential and make the most of their talents.

The EEF aims to raise the attainment of children facing disadvantage by:

- Identifying promising educational innovations that address the needs of disadvantaged children in primary and secondary schools in England;
- Evaluating these innovations to extend and secure the evidence on what works and can be made to work at scale;

Encouraging schools, government, charities, and others to apply evidence and adopt innovations found to be effective.

The EEF was established in 2011 by the Sutton Trust, as lead charity in partnership with Impetus Trust (now part of Impetus-The Private Equity Foundation) and received a founding £125m grant from the Department for Education.

Together, the EEF and Sutton Trust are the government-designated What Works Centre for improving education outcomes for school-aged children.

For more information about the EEF or this report please contact:

Robbie Coleman
Research and Communications Manager
Education Endowment Foundation
9th Floor, Millbank Tower
21-24 Millbank
SW1P 4QP

p: 020 7802 1679
e: robbie.coleman@eefoundation.org.uk
w: www.educationendowmentfoundation.org.uk

About the evaluators

The evaluation teams were led by John Jerrim (Institute of Education) and Anna Vignoles.

John's research interests include randomized controlled trials, access to higher education, intergenerational mobility, cross-national comparisons and educational inequalities. He has worked extensively with the Programme for International Student Assessment (PISA), and has recently returned from working at the OECD. John won the inaugural ESRC Early Career Outstanding Impact award and has just received an ESRC grant to study cross-national comparisons of educational attainment and social mobility.

Anna Vignoles is Professor of Education at the University of Cambridge. She has published widely on the impact of school resources on pupil achievement and on the socio-economic gap in pupil achievement. Her research interests include issues pertaining to equity in education, school choice, school efficiency and finance and the economic value of schooling. Anna is a Research Fellow at the Institute for Fiscal Studies and a Visiting Professor at the Institute of Education. Anna has advised numerous government departments, including the Department for Education and the Department of Business, Innovation and Skills. Anna is also the economist member of the NHS Pay Review Body.

Professor Richard Cowan (Institute of Education, University of London) provided assessment advice on the primary study.

Contact details:

Dr. John Jerrim
Institute of Education, University of London
20 Bedford Way
London
WC1H 0AL

p: 07590 761 755
e: J.Jerrim@ioe.ac.uk

Executive summary

The programme

The Mathematics Mastery programme is a whole-school approach to teaching mathematics that aims to raise attainment for all pupils and close the attainment gap between pupils from low income families and their peers. The programme aims to deepen pupils' conceptual understanding of key mathematical concepts. Compared to traditional curricula, fewer topics are covered in more depth and greater emphasis is placed on problem solving and on encouraging mathematical thinking.

This summary is based on two randomised controlled trials of Mathematics Mastery funded by the Education Endowment Foundation. The first evaluation assessed the impact of the programme on pupils in Year 1. 83 schools from London and the South East participated in the trial, with a total sample of 4,176 pupils. The second assessed the impact of the programme on pupils in Year 7. 44 schools from London and the South East participated in the trial, with a total sample of 5,938 pupils.

Both evaluations assessed the programme's impact in its first year of adoption. In subsequent years it was intended that schools would begin to use the approach with older year groups until it was in place across all year groups. The education charity Ark provided participating schools with training and resources to support the adoption of the programme.

Separate evaluation reports from the primary and secondary trials are also available on the EEF website.

Key conclusions
1. This summary is based on findings from two randomised controlled trials conducted in English schools between 2011 and 2014.
2. On average, pupils in schools adopting Mathematics Mastery made a small amount more progress than pupils in schools that did not. The effect detected was statistically significant, which means that it is likely that that improvement was caused by the programme.
3. It is unclear whether the programme had a different impact on pupils eligible for free school meals, or on pupils with higher or lower attainment.
4. Given the low per-pupil cost, Mathematics Mastery may represent a cost-effective change for schools to consider.
5. The evaluations assessed the impact of the programme in its first year of adoption. It would be worthwhile to track the medium and long-term impact of the approach.

What impact did it have?

On average, pupils in schools adopting Mathematics Mastery made more progress than similar pupils in schools that did not adopt the programme. The small positive effect can be estimated as equivalent to approximately one month's additional progress. The effect detected was statistically significant, which means that it is likely that that improvement was caused by the programme.

The programme had a higher impact on pupils in Year 1, who made approximately two additional month's progress on average, than those in Year 7, who made approximately one additional month's progress on average.

It is unclear whether the programme had a different impact on pupils' eligible for free school meals or on higher or lower attaining pupils than on higher attaining pupils.

In follow-up studies, data from SATs and GCSEs should be used to evaluate the medium and long-term impact of the programme on different groups of pupils.

How secure is this finding?

Overall, the findings related to Mathematics Mastery noted here are judged to be of moderate security. They are based on two large randomised controlled trials conducted in English schools over the period 2011-2013. Findings from both individual studies were judged to have been of moderate security.

The findings from the individual trials have been combined using an approach called "meta-analysis". Meta-analysis can lead to a more accurate estimate of an intervention's effect. However, it is also important to note that care is needed in interpreting meta-analysed findings. Due to the ages of pupils who participated in the individual trials, the headline findings noted here are more likely to be predictive of programme's impact on pupils in primary school than on pupils in secondary school.

The evaluation team are not aware of any other high-quality evaluations of Mathematics Mastery that have been conducted. However, were new evaluations to be published in the future, these should be combined with the two studies noted above to provide a more accurate overall impact estimate.

The findings were substantially lower than the average effects seen in the existing literature on of "mastery approaches". A possible explanation for this is that many previous studies were conducted in the United States in the 1970s and 80s, so may overstate the possible impact in English schools today. An alternative explanation is that the Mathematics Mastery programme differed from some examples of mastery learning previously studied. For example classes following the Mathematics Mastery approach did not delay starting new topics until a high level of proficiency had been achieved by all students, which was a key feature in a number of many apparently effective programmes.

How much does it cost?

The average 'per pupil' cost of the intervention is estimated to be around £131 per year for primary school pupils and around £50 per year for secondary school pupils, in the first year, with per pupil costs likely to reduce in future years in both cases.

Group	Number of pupils (schools)	Effect size (95% confidence intervals)	Estimated months' progress	Evidence strength*	Cost
Overall impact	10,114 pupils (127 schools)	+0.073 (0.00, +0.14)	+1 month	🔒🔒🔒🔓🔓	££
Primary vs. comparison	4,176 pupils (83 schools)	+0.10 (-0.01, +0.21)	+2 months	🔒🔒🔒🔓🔓	££
Secondary vs. comparison	5,938 pupils (44 schools)	+0.06 (-0.04 to +0.15)	+1 month	🔒🔒🔒🔒🔓	£

*For more information about evidence ratings, see Appendix A below.

Appendix A: Meta-analysis of the Mathematics Mastery primary school and secondary school randomised controlled trials

Two Mathematics Mastery trials were conducted simultaneously. The 'primary school' trial introduced Mathematics Mastery to Year 1 pupils (5/6 year olds) and took place over two academic years (September 2012 to August 2013 and September 2013 to August 2014). The 'secondary school' trial was conducted in the September 2013 to August 2014 academic year, with the focus on Year 7 pupils (11/12 year olds). A summary of this is presented in Appendix Table A, along with a meta-analysis of the results (note that the primary and secondary school trials have been given equal weight).

The reported effect size is similar across the two trials (0.10 for primary school and 0.06 for secondary school) though neither individually reaches statistical significance at the five per cent level. Precision is increased, however, when information is combined across the two. Indeed, the pooled effect size of 0.073 is just significantly different from zero at conventional thresholds. Overall, these results support the conclusion that even a one year dose of the Mathematics Mastery intervention leads to a small (yet potentially cost-effective) improvement in children's maths test scores.

Table A. Meta-analysis results

	Primary school	Secondary school	Meta (combined)
Number of schools	83	44	127
School response rate	92 per cent	88 per cent	-
Number of pupils	4,176	5,938	10,114
Pupil response rate	82 per cent	77 per cent	-
Effect size	0.099*	0.055	0.073**
Standard error	0.054	0.046	0.035
95% confidence interval	-0.009 to 0.207	-0.037 to 0.147	0.004 to 0.142

Notes: *Authors' calculations. Meta-analysis has been weighted by standard error. Overall test scores (pre-specified primary outcome) have been reported for both trials. Huber-White adjustments have been made to all standard errors to account for clustering at the school level. * and ** indicate statistical significance of effect sizes at the 10 per cent and five per cent levels respectively.*

Note on evidence security

The overall security rating is based on the security ratings of the individual randomised controlled trials. The estimate of moderate security ("three padlocks") is based on the study with the weakest individual study, which received three padlocks. For more information about security ratings in individual reports, see Appendix A in the primary report and Appendix C in the secondary report.

This document is available for download at **www.educationendowmentfoundation.org.uk**

Education
Endowment
Foundation

The Education Endowment Foundation
9th Floor, Millbank Tower
21–24 Millbank
London
SW1P 4QP
www.educationendowmentfoundation.org.uk