Centres for Excellence in Maths Teaching for Mastery Randomised Controlled Trial

Evaluation Report

Summary

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About the evaluators

The project was independently evaluated by a team from the University of Nottingham Education: Geoff Wake, Michael Adkins, Diane Dalby, Jonathan Hall, Marie Joubert, Gabriel Lee, Andy Noyes.

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Executive summary

Introduction

The Centres for Excellence in Mathematics (CfEM) programme is a national improvement project aimed at delivering a step change in mathematics teaching up to Level 2 in post-16 settings. It involves 21 Centres for Excellence in Mathematics (predominantly General Further Education Colleges (GFECs)) and a consortium of expert delivery partners, managed and led by the Education and Training Foundation (ETF).

The programme activities in 2019/2020 included a set of pilot research trials, the initial stages of the development of local college networks and action research projects situated in the Centres. In this period the University of Nottingham (UoN) Centre for Research in Mathematics Education (CRME) conducted four pilot research trials (October 2019 – April 2020). In each trial, teachers used a different approach to teaching mathematics with students studying to resit their GCSE examinations. The four themes explored teaching for Mastery, using contextualisation, working with technology, and improving motivation and engagement). In March 2020 national measures were taken to combat the Covid-19 pandemic. This closed schools and colleges and eventually led to the cancellation of GCSE examinations. This meant that all work on the pilot research trails ceased, and the research team was only able to report on a much truncated set of outcomes of these pilots.

Covid-19 continued to impact substantially on education nationally, including colleges, throughout much of the following year and GCSE examinations were again cancelled in 2021. During that period the CRME research team continued to work building on the experiences of the pilot trials to develop an intervention based on Teaching for Mastery (TfM) and designed and prepared for a randomised controlled trial (RCT) of this. The design was for a three-armed RCT that investigated (i) a partial intervention that fundamentally relied on a brief programme of professional development (PD) and exemplary lessons to illustrate the approach that were taught spaced out during the year and (ii) a full intervention that in addition to these elements included a programme of modified lesson study phased over the teaching period October (2021) – March (2022).

Context

The context of the Centres for Excellence in Mathematics is a response to government concern about the mathematical skills of adults, particularly with respect to skills needed for work. This has long been a concern identified by various stakeholders (e.g., Confederation of British Industry, 2015). The importance of mathematics was highlighted in the current government's Industrial Strategy (BEIS, 2017), with indications of an intention to address deficits where they occur. Professor Sir Adrian Smith's review of post-16 mathematics in 2017 (Smith, 2017) considered ways of improving mathematics education for the 16-18 age cohort. This included a review of the mathematical needs of post-16 students and concluded that there was strong demand for mathematical and quantitative skills in the labour market at all levels and consistent

undersupply and adults with basic numeracy skills earn higher wages and are more likely to be employed than those who fail to master basic quantitative skills. The review also suggested that there was a need for further investment to improve mathematics teaching in Further Education (FE) colleges.

Over one third (34%) of students aged 16-18 study in either General FE or Sixth Form colleges (Association of Colleges, 2020), with the majority following vocational study programmes. Mathematics progress measures suggest that many students with low prior attainment in mathematics (i.e., GCSE grade 3 or below) do not make any measurable progress, in terms of their GCSE mathematics grade, by age 19 and GCSE pass rates for these students indicate that less than twenty percent attain the desired grade 4 or above (DfE, 2019). These data signal the scale of the problem.

The Teaching for Mastery intervention

The intervention was designed to improve post-16 students' learning of level 2 mathematics. In general, the approach used was one of teaching for mastery in FE, aligned to principles developed by teachers and educators working with the Centres for Excellence in Maths programme. A Handbook sets out these principles alongside advice relating to teaching in this way.

The intervention targeted teachers of students undertaking post-16 GCSE mathematics resit classes. The aim was to support the teachers to develop new teaching practices aligned with the Mastery Teaching principles by engaging with professional development that explained the approach and working with seven lessons that exemplified this. Five of the lessons were taught in specific time frames over the duration of the course using these to inform their developing teaching approach. There were two levels of intervention investigated: a partial intervention that included all the aforementioned and a full intervention that in addition included a programme of a modified version of lesson study. The lesson study was led by a small cohort of Lead Teachers who had taken part in an earlier pilot and who had some additional online training. Teachers in this arm of the trial were clustered geographically to take part in the lesson study process.

The evaluation was a three-armed randomised controlled efficacy trial, involving 147 colleges and 7453 students. The process evaluation included teacher surveys and 13 case studies. Recruitment to the trial was managed by Centre Leads of the CfEM and drew on teachers from Centres and their wider partner networks. The intervention ran in colleges from October 2021 to June 2022. During this period illness due to Covid-19 and college-imposed visiting restrictions proved an issue for teachers and students resulting in some PD sessions and cluster meetings being held online instead of face-to-face as originally planned. Covid-19 also led to some attrition of teachers from the trial as workload proved difficult due to illness of participating teachers and their colleagues.

Table 1 Key conclusions

Key Conclusions
1. GCSE resit students taught by teachers in the full Mastery Teaching intervention made one month additional progress in mathematics learning compared to students in other (business as usual) colleges.
2. Students having had Free School Meals prior to college, and taught by teachers participating in the full Mastery Teaching intervention, made two months additional progress in mathematics learning compared to students in other (business as usual) colleges.
3. Teachers in both intervention groups report that taking part in the PD intervention programme and teaching the exemplary Teaching for Mastery lessons as: ■ being effective as an introduction to the principles of Teaching for Mastery ■ leading to their improved understanding of how to implement Teaching for Mastery in their practice ■ leading to changes in their teaching practice during the programme and high levels of intended change in teaching practice (in subsequent years) ■ resulting in improved student engagement and understanding.
4. Compliance was generally fair, with close to two-thirds of settings in both arms of the intervention teaching lessons 1-4. Compliance decreased for both arms in the teaching of lesson 5 with over half of teachers in the full intervention, but only just over two-fifths of the partial intervention teachers teaching the final lesson. There was high fidelity in terms of the lesson aims and design in the teaching of the sample lessons and teachers reported trying to implement the Teaching for Mastery approaches in their other lessons.

Additional findings

At a more detailed level we investigated a secondary outcome impact measure based on a sub-scale score for GCSE questions that aligned with the content of the exemplary Teaching for Mastery lessons taught by teachers in both full and partial intervention groups.

Analysis confirms that of the primary outcome measure and detects a slightly greater impact on (FSM) students taught by teachers in the full intervention. This again gave an effect size (of 0.13) that suggested two months of additional progress.

The intervention was delivered as intended. Lead teachers report being highly engaged with the training sessions that prepared them for working with the Trial Teachers and increasing their knowledge over the course of the phased PD of the mastery approach, the exemplary lessons and the lesson study approach. Likewise, the Trial Teachers report their growing understanding of the mastery approach over the course of the year. Trial Teachers worked hard to follow the mastery approach within the trial lessons, although in some cases this entailed making significant changes to their teaching, such as allowing students to struggle

towards understanding. Most made only minor changes to the lesson plans to take account of individual classes they were teaching. The teachers reported that they were increasingly using these approaches in their other lessons, mainly in terms of spending more time on whole class discussion and extended pair work.

The intervention took place during the course of the academic year 2021-22 with the GCSE examination taking place in June 2022 for the first time in three years because of disruption due to the Covid-19 pandemic. The pandemic led to two issues that should be considered in relation to the implementation and results of the intervention.

First, the students 'resitting GCSE' had not in fact taken a GCSE examination previously and had experienced a very disruptive period of learning in Years 10 and 11 prior to being at college. This impacted on the cohort of students in the study in a number of, predominantly negative, different ways. In particular, their motivation and engagement with learning was potentially negatively impacted and the cohort as a whole was likely to have been less well-prepared mathematically than previous cohorts.

Second, illness due to covid was particularly disruptive over the winter months of the intervention period. The original design of the intervention involved face-to-face PD meetings for Lead Teachers and Trial Teachers. Lesson Study style cluster meetings for teachers in the full intervention were also planned to be face-to-face (an important part of the process). Unfortunately, all PD sessions were held online because of covid restrictions, often imposed by colleges, and due to illness of teachers and colleagues. Likewise, two of the planned five cluster meetings were also held online. Contingency plans had been put in place in preparation of the intervention in the likely event that this was going to happen. These plans were put into operation.

Cost

The average cost of Maths Mastery in FE for one setting was around £4,107.5 or £50.02 per student per year when averaged over three years. This assumes 30 students per year, rising cumulatively from 30 students in the first year to 90 students in the third year, however, given the condition of funding requirement, there will be students resitting GCSE Mathematics several times. We have not adjusted the costs to take account of this. We would expect the costs to be further reduced in a broader scale up. In the materials only arm, the costs per student averaged over three years was estimated at £18.92.

Impact

Table 2 Summary of impact on primary outcome, and primary and secondary contrasts (Source: ONS)

Outcome & Group	Effect Size (95% Credible Interval)	Estimated months' progress[1]	No of pupils observed (intervention; control)
GCSE Mathematics standardised raw score (z-score by board) Full intervention vs. Control[2]	0.06 (-0.12, 0.24)	1	2516 (889, 1627)
GCSE Mathematics standardised raw score – Free School Meal (FSM) students Full intervention vs. Control[2]	0.11 (-0.10, 0.32)	2	903 (323, 580)
GCSE Mathematics standardised raw score (z-score by board) Partial intervention vs. Control[3]	0.04 (-0.16, 0.25)	0	2501 (874, 1627)
GCSE Mathematics standardised raw score – Free School Meal (FSM) students Partial intervention vs. Control[3]	0.03 (-0.19, 0.25)	0	896 (316, 580)

[1] Estimated months' progress is based on effect sizes reported in British and international research studies. For more information, see https://educationendowmentfoundation.org.uk/education-evidence/using-the-toolkits; [2] Primary contrast, see the results section for more information; [3] Secondary contrast, see the results section for more information

The full report of the Trials gives full details relating to the intervention programme, how this was implemented and evaluated. The evaluators warn that it is important to consider these details before interpreting the outcomes presented here in any detail.