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Mathematics in England's Further Education Colleges: an analysis of policy enactment and practice

The Mathematics in Further Education Colleges Project:
Interim report 2 (Executive Summary)

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Executive summary

The importance of mathematical skills to individuals, to the economy and to society, is widely agreed and well documented. Improving the skills base in England is therefore a national priority as evidenced in the Industrial Strategy[1]. At one level this includes concerns for increasing engagement with A-level and other Level 3 mathematics qualifications (e.g. Core Maths). Yet it is in England's General Further Education Colleges (GFECs[2]) that the drive to improve the nation's mathematical skills is being most sharply felt. Here the Condition of Funding[3] (commonly referred to as the GCSE re-sit policy) is aiming to tackle low prior attainment and maximise GCSE passes at grade 4.

Mathematics education in this sector is critical to addressing national skills needs but is under-researched and poorly understood, as highlighted in Professor Sir Adrian Smith's Treasury-commissioned report (2017)[4]. The majority of 16-18-year-old students with low prior attainment in mathematics are studying in general FE colleges, mostly on vocational study programmes. Their progress with mathematics remains slow with only 18.7% of 16-18-year-olds re-sitting GCSE mathematics in 2018 achieving the required grade[5].

The Mathematics in Further Education Colleges Project (MiFEC) comprises the latest and most extensive research analysis of the state of mathematics education in England's FE colleges. The first Interim Report (December 2018) focused on a national survey of the mathematics teacher workforce. This second Interim Report is a wide-ranging analysis of policy enactment and practice in a sample of 32 English FE colleges from 2017 to 2019. The project's Final Report (due summer 2020) will synthesise the project findings and make recommendations for stakeholders including policymakers, college managers, curriculum leaders and Continuing Professional Development (CPD) providers.

This Interim Report sets out the challenges faced by colleges when enacting post-16 mathematics qualifications policy. It explores how variations in context, curriculum, management, organisation, pedagogy, attitudes and aspirations blend to shape learner experiences and outcomes. There are important differences between mathematics education in FE colleges and schools, including the nature of the student cohort, the organisation of educational provision and the teaching and learning approaches used. These differences have important implications for improving student outcomes.

The case study analysis reported herein addresses several of the project's research questions:

- How do FE colleges *mediate*, *moderate* and *modulate* government policy on post-16 mathematics education?

[1] BEIS. 2017. Industrial Strategy: building a Britain fit for the future. London: HMSO.
[2] GFECs form the major part of the Further Education (FE) sector. Other FE colleges (e.g. Sixth Form Colleges, specialist colleges) may identify with some of the issues raised but the size of provision and organisational complexity of large GFECs means this has been the main focus of this study. Where we use FE Colleges, it refers to GFECs
[3] The Condition of Funding (commonly referred to as the GCSE retake, or re-sit policy) made it compulsory from September 2014 for students without GCSE Grade C (now Grade 4) to either retake GCSE mathematics or undertake a 'stepping stone' mathematics qualification, with the aim of then progressing on to a GCSE retake course.
[4] Smith, Adrian. 2017. "Report of Professor Sir Adrian Smith's review of post-16 mathematics." London: DfE.
[5] DfE. 2019. Revised A level and other 16-18 results in England, 2017/2018. London: DfE.

- What different strategies have been employed?
- How has/is funding shaping college policy and classroom experience?
- What are the workforce strengths and limitations?
- How is curriculum and assessment changing?
- What are the possible unintended consequences of policy upon classrooms?

The 32 case study general FE colleges were either single providers or part of a college group and comprised around one sixth of 187 similar providers at the time (Sept 2017). This sample was stratified across the nine regions of England and based on key selection criteria: size (number of 16-18s); type of provision (vocational only or academic and vocational); location (e.g. *urban major* or *minor conurbation*); mathematics progress measure and most recent Ofsted grade.

Each case involved at least one face-to-face visit, during which individual interviews were carried out with senior leaders, managers, mathematics teachers and vocational staff as well as focus groups with students. In total the field work involved 44 site visits, 238 interviews and 62 student focus groups[6]. Documentary evidence was also provided by colleges on their structures, staffing and strategies for mathematics. Data was also collected about adult and academic provision but the dominance of GCSE and Functional Skills in policy discourse and college provision means that this is the main focus of this report. Although the interview data comprise the subjective points and angles of view of a range of actors (e.g. managers, teachers, students), the scale of the dataset, overlapping design of interview schedules and triangulation through reference to other data sources produces a comprehensive and trustworthy dataset. Whilst we cannot claim statistical generalisability we do aim for analytic generalisability.

Main findings

The main report begins with three anonymised college case reports that have been selected as a means of introducing some of the main issues faced by FE colleges. These are followed by more in-depth cross-case analysis of the full set of studies, organised into nine themes. The key points from these themes are summarised below.

College contexts and curriculum offers affect mathematics provision

The FE colleges in the study do not all offer the same range of vocational and academic qualifications. This affects the size and profile of mathematics provision but also impacts on teaching, since motivation to study mathematics and general study skills vary between students on different types and levels of study programme. The distribution of college provision across sites also has an impact on mathematics teachers' working practices due to variations in site cultures and resources that impact on itinerant or site-based teachers in different ways. At an institutional level, contextual differences between colleges mean that the challenges for providers with mathematics are not the same but this is not taken into account in comparisons of college performance (i.e. maths progress measure, GCSE high grade achievement).

[6] The analysis of data from the student focus groups is not included in this report but will form the basis of a separate working paper

The mathematics qualifications and progression pathways that the colleges offer to their 16-18-year-olds are not the same, which leads to variations between colleges in students' experiences of mathematics. Although colleges in the study state that students' needs are considered, decisions are also influenced by college comparisons of performance and the efficacy of the qualifications.

Leadership and management of mathematics is a whole college responsibility

The management of mathematics in the case study colleges involves a sharing of responsibility between mathematics and vocational staff. Active involvement of senior leaders, in collaboration with staff at different levels, is important to support implementation and staff well-being. Full commitment from vocational staff is vital to ensure strategies and systems for mathematics provision are implemented effectively. Cross-college managers of mathematics are key players who carry out distinctive and complex roles in these shared responsibility systems. There is little evidence of any specific training for these positions but there are strong indications of the need for better understanding of these roles and a bespoke training scheme.

Structural arrangements for the management and staffing of mathematics vary widely between these colleges. A range of models is in use, each with desirable and undesirable consequences. An evaluation of the advantages and disadvantages of these models, alongside college priorities and contextual constraints, is needed to determine the 'best fit' for an individual college. Colleges would benefit from guidance on this process and how to plan accompanying actions to minimise the disadvantages of their chosen model.

Operational strategies are complex and dependent on the college context

Designing and maintaining effective operational systems and processes for mathematics is a complex and time-consuming task due to the size and dispersion of provision. The colleges in the study work hard to timetable mathematics in ways that will encourage good attendance, often fitting the rest of the study programme around mathematics and English. Decisions about the location of mathematics classrooms and the streaming of classes include considerations of the impact on student learning but college-specific factors such as staffing structures, student numbers and their dispersion across sites limit the practical possibilities. The teaching time allocated varies between colleges but the practice of allocating less time to Functional Skills than GCSE means that the least able students are often disadvantaged. Considerable time and resource are used to follow up on poor attendance, which is considered the largest hindrance to student achievement, but systems and resources are not always adequate for the scale of the task. Inefficiency in general college operations such as enrolment, a delayed start to mathematics courses or extended 'settlement' time for classes at the beginning of the year all result in teaching time being lost for mathematics. Colleges offer a range of additional learning opportunities for those who miss lessons or need extra support but these have limited impact since those in most need are least likely to attend.

Students' backgrounds, prior experiences, attitudes, and aspirations matter

Staff report how family backgrounds and the prevailing culture in the local area influence students' aspirations and values, which lead to different motivations and attitudes to mathematics. Those colleges located in socially deprived areas encounter significant challenges with mathematics, especially when students' intentions are to obtain local low-

skilled employment. Those aspiring to more skilled positions or Higher Education for which GCSE mathematics is an entry requirement typically have stronger motivation, although short-term thinking often prevails. Inconsistency about entry requirements can however undermine the key message that mathematics is important. Students with low aspirations tend to be more convinced about the relevance of mathematics when they understand why it is useful to them. Vocational teachers are seen to be in a strong position to exert positive influences over students through implicit or explicit communication but their commitment to student learning of mathematics varies.

Teachers report that students with prior experiences of failure with mathematics often have negative attitudes, which act as barriers to learning. Mathematics teachers need the skills to address these issues by using pedagogies that are responsive to students' needs, allowing them to build confidence and resilience. The prevalence of insecure foundational mathematical knowledge and under-developed study habits is also a challenge when teaching a one-year revision course. Without personal motivation and a change of attitude to mathematics, colleges find that enforced attendance is unlikely to lead to learning. There can also be a detrimental effect on students with emotional or attitudinal problems from the enactment of a compulsory mathematics policy, resulting in increased demands on mathematics teachers to manage challenging behaviour in classrooms.

Teaching needs adapting in multiple ways to meet students' needs

The majority of mathematics teaching in FE colleges involves students who are retaking mathematics on a GCSE or Functional Skills course. Mathematics teachers in the study identify a need for context-specific variation in teaching, using different adaptive pedagogies and resources to meet students' needs. This includes adaptations designed to engage students, differentiate, contextualise, connect to vocational programmes, align with different vocational pedagogies and make effective use of diagnostic assessment. Teachers' pedagogical choices are also influenced by organisational decisions, which determine the composition of their groups and how rigidly they are expected to adhere to pre-planned schemes and lessons. Teaching mathematics in FE primarily involves working with low-attaining students who consider themselves 'failures' and teachers in the study have concerns that the timescale for demonstrating measurable improvement on retake courses is often unrealistic. Contextual factors mean that teaching GCSE (or Functional Skills) in post-16 education can be very different from teaching the same qualification to pre-16s in school and there is a need for sector-specific training to prepare mathematics teachers for the FE context.

A growing teacher workforce has diverse strengths and development needs

The Condition of Funding has led to changes in the mathematics teacher workforce with more permanent positions and specialist teachers (e.g. teaching GCSE only). The colleges have worked hard to deal with the widespread difficulties of recruiting enough teachers to meet the increase demand. Expanding the workforce at the time of a national shortage of mathematics teachers has required innovative and costly recruitment strategies for colleges. Colleges would benefit from government funding and intervention to attract more teachers into FE mathematics teaching who have the motivation and personal qualities to be successful in this area of education. Mathematics teaching teams typically include teachers from varied backgrounds with diverse skills and experience who have varied training needs depending on their entry route into mathematics teaching in FE. Even those

who move into FE mathematics teaching from other settings (e.g. schools) need a transition period, with targeted training, to adapt and develop specific skills for teaching low-attaining students in the FE context. The mathematics teacher workforce is under heavy pressure to produce better results, which can be demotivating and some colleges report that current staffing levels are not sustainable.

Training and professional development needs to be improved

There is wide variation in the quantity and type of CPD provided for mathematics teachers by the case study colleges. Designated additional funding for professional development and a personal CPD entitlement would enable a more consistent approach. Teachers report that formal CPD sessions often focus on general pedagogy without application to their own teaching situation and that CPD from external providers for mathematics is often repetitious, without evidence of impact in the FE sector. The colleges need better information from CPD providers about their offer and evidence of impact in the sector. College managers would also benefit from evidence-based guidance about effective CPD models. Teachers state that they benefit most from informal sharing of ideas in teams and CPD that is directly related to their mathematics classroom practice. There is potential for the stronger college-based professional learning communities and more robust practitioner-led research within FE but colleges need specific training and support to develop these. Teachers identify specific skills that are important to be an effective mathematics teacher in FE, such as engaging disaffected students and managing challenging behaviour, that could be more prominent in initial teacher training and CPD. For vocational teachers, the main CPD need identified is to develop personal confidence with mathematics. Colleges are addressing this in various ways but greater emphasis in initial teacher training would alleviate the need for remedial action later.

Change and consolidation need to be better balanced

The colleges in this study are often managing multiple overlapping changes in policy. In order to develop long-term strategies for improvement in mathematics, more clarity, support and time are needed to embed important changes. The Condition of Funding has had a positive effect by raising the status of mathematics in colleges and increasing the level of shared responsibility. Implementation has however been demanding and costly due to the extensive re-organisation, recruitment and development required. Many respondents report that student behaviour and attitudes to mathematics have deteriorated and become more time-consuming to manage. Other changes (e.g. Ofsted, mergers) have had varied effects on mathematics provision, depending on their handling by senior management. College managers express a desire for a time of policy and curriculum stability for mathematics, although they themselves perpetuate change through internal reviews and changes to strategy, driven by the need to demonstrate measurable improvement in student outcomes.

Towards better post-16 mathematics qualification policy

There is wide agreement across the case study colleges that the Condition of Funding is flawed and needs to be reviewed, mainly due to concerns that GCSE Mathematics grade 4 is not an appropriate or realistic goal for all students. A common view is that more appropriate qualifications and goals for all students are needed in future policy, based on a better understanding of the student cohort. Managers and teachers are generally of the

opinion that extending compulsory mathematics to age 18 is unrealistic at present since it would require a suitable suite of qualifications. There are also concerns about students' responses to such a policy. Colleges identify a need for future policies and qualifications to be developed that retain the flexibility for the college to make decisions that are in students' interests, accommodating different needs and including realistic goals.

Conclusion

The comprehensive analysis set out in the full report highlights the considerable complexity of providing mathematics qualifications for 16-18-year-olds in England's general further education colleges. We have deliberately reported our findings in detail as we are keen to avoid the error of thinking that improvements can be achieved with simple solutions, or that a successful intervention in one area of the system (e.g. classrooms) can be made independently, without considering other aspects of that interconnected system (e.g. operational strategy or staffing).

The complexity of mathematics provision in general FE colleges is the product of the different spatial and temporal scales of the educational system interacting with varied local and regional needs of learners, communities and society. Understanding this multi-scale complexity, both societal and educational, is a prerequisite for considering how actors with different positions, roles and influence in this system might work to improve outcomes, whether individual, organisational or societal. Our analysis provides a detailed account of how mathematics policy is enacted in such colleges and highlights some key areas where the investment of further resources seems likely to lead to worthwhile improvement. We are not however making major recommendations at this stage. These will come in the forthcoming MiFEC Final Report, due to be published in the summer of 2020.