'The new normal': emerging evidence for pandemic-related change in opportunity to learn mathematics in English secondary schools

Jennie Golding[1], Benjamin Redmond[2] and Grace Grima[2]

[1]*University College London,* [2]*Pearson UK*

In England, pandemic constraints often resulted in reduced mathematics performance, with variable recovery from such learning loss. However, the nature of, and reasons for, emerging post-pandemic classroom practice and experience are less clear.

We report on the 'new normal' in five secondary mathematics departments, fairly representative in several key characteristics, and four of whom we worked with pre-pandemic. In each school, a late 2022 two-day 'deep dive' visit explored the experienced curriculum breadth and balance, the development in mathematics of problem solving, reasoning, communication and affect, and the use of digital tools for learning.

We analyse pre-to-post pandemic changes in opportunities to learn in those areas, the reasons given, and how changes appear to vary with department- or student-related characteristics. We identify important features of teacher-level capacity and (physical, emotional and cognitive) support as key in these schools to sustaining more ambitious learning experiences post-pandemic.

Keywords: pandemic impact; opportunity to learn; digital resources; textbooks

Background

The global pandemic of 2020-22 had a sustained, and significant, impact on schools in England, with continuing school-level evidence of funding constraints, challenges recruiting and retaining teaching staff, and growing mental health needs among pupils following considerable impact on social, emotional and cognitive development (Committee of Public Accounts, 2023). There was a sustained reduction in the mathematics learning of many young people, as measured by standardised attainment tests: recent large-scale studies have shown average performance in mathematics, while recovering, still lagging by 1.3-1.4 months at age 11 and the gap in standard outcomes between disadvantaged young people and their peers at ages 11 and 16 at its widest since 2012 (e.g. Andrews, 2023). Standardised measures can of course mask other developments, positive or negative, that impact mathematical thriving.

We have recently (2016-2022) conducted a series of studies exploring the enactment of the 2014 mathematics national curriculum in England, and the use and impact of related curriculum resources. In our 2018-22 Power Maths 'classroom-close' study in English primary schools we were able, serendipitously, to evidence schools' mathematics education response to the pandemic, and latterly, their early experiences in moving to a post-pandemic 'new normal' (Golding et al., 2022a; Barrow et al., 2021). We showed that practice, and opportunity to learn, varied widely between classrooms, even in the same school, with some children enjoying aspirational, challenging and empowering mathematics post-pandemic and other classrooms where experiences remained comparatively constrained, particularly in terms of mathematical problem-solving, reasoning and communication. Our 2017-21

'A-Level' (pre-university) mathematics study of 16-18 year olds also showed the pandemic had often resulted in limited *synthesis* of learning, with a consequent limitation to student self-efficacy (Golding, 2021). However, there is a gap in 'classroom-close' evidence for English secondary (ages 11-16) students in- and post-pandemic, whose attainment is typically assessed in GCSE examinations at age 16. The reported study therefore set out to answer: ***What is the 'new normal' in secondary mathematics in England? How is curriculum breadth and balance being experienced, with what resources, why, and what is the impact on learning?*** (and as sub-questions catalysed by findings in the above studies, *What are the levers and drivers? How are problem-solving and reasoning, development of mathematical communication, use of digital tools within mathematics lessons, mathematics affect being developed, and with what resources? How have those decisions been impacted by the pandemic, and how stable is the current provision? What are teacher and student perceptions of current performance measures at age 16?)*

Methodology

We adopted an institutional ethnographic approach (Smith, 2005) in order to access teachers' and students' lived perspectives on their recent and current mathematics education experiences. Ethical consent was given by the first author's university REC. We used five 'deep dive' case-studies, in four schools we had worked with previously, giving us a 'baseline' knowledge of earlier school mathematics norms (Golding et al., 2018). The fifth school was purposively chosen as a government-promoted 'free school'. Between them, the five schools featured a variety of characteristics known to be related to teaching and learning (size, governance, nature of catchment area, previous inspection rating, prior student attainment). Pre-visit in late 2022, we gleaned core school, and particularly mathematics, information from each school website, and then via a recorded and transcribed online interview with the five Heads of Mathematics, key actors in English secondary school mathematics. We then spent two intense days in each school, making further contextual notes. In each school, for each of four study classes in different year groups 7 to 11 (students aged 11-16), we conducted:

- A full semi-structured lesson observation (Data: 20 sets of observation notes)
- A post-lesson focus group with mixed group of 4-6 students (Data: 20 focus group transcriptions)
- A study class teacher semi-structured interview (Data: 20 interview transcriptions)

Data were analysed using reflexive deductive thematic analysis (Braun & Clarke, 2022), with analysis shared and validated across the research team. The study was funded by Pearson, the market leader in English secondary mathematics education resources and assessments (and earlier studies were in schools using Pearson resources). The first author carried out all fieldwork, with analysis and some writing drafted by the Pearson research team. There are therefore obvious additional questions of research trustworthiness and integrity, detailed elsewhere (Golding et al., 2022b), and addressed largely through researcher reflexivity, and extensive cross-researcher and participant validation. We report findings under broad research sub-headings, including also indicative comparison with pre-pandemic norms in each of the four case study schools with whom we had worked previously.

Findings

Teaching and Learning

Observed lessons varied considerably in approach, both within and across schools - but were almost always organised throughout around a (department- or teacher-developed) PowerPoint. This was in contrast to reported and observed practice pre-pandemic, when PowerPoints, often from commercial sources, were common in the first phase of a lesson, but less so thereafter: we characterise this as a move from PowerPoint-supported, to Power-Point led, lessons. This move was accompanied by a significant reduction in use of textbooks, with no such use in any of the 20 lessons observed. Teachers varied in the effectiveness of their use of PowerPoint-led lessons, with most appearing fairly constrained by slide content, whereas others were able to deviate from planned structures if student response suggested that would be beneficial. However, there was little evidence of a focus on 'mastery' as promoted by national initiatives.

Some teachers had restructured their planning in response to evidenced pandemic-related gaps, while others aimed to address difficulties as they arose; both approaches were variably enacted. However, teachers commonly reported renewed pressures relating to the intended curriculum depth and breadth, and that this limited their capacity to actively respond to unexpected student needs. Teachers in two of the five schools reported increasing issues of high teacher turnover, and limited teacher subject knowledge and often, experience, and these issues were said to threaten the quality of teaching and learning achievable. In contrast, in one school strong leadership and a strongly mathematically-equipped/talking staff appeared to support generally higher quality levels of aspiration.

Curriculum breadth, balance and authenticity

The 2014 national curriculum promotes a renewed emphasis on mathematical problem-solving, reasoning, communication and cross-curricular and contextualised connections. Our studies pre-pandemic had shown those variably enacted, and largely still fragile, across school phases. In 2022 they remained variable by teacher, with several individual teachers reporting that their aspirations varied by class. In four of 20 classrooms students were reaching good levels of such mathematisation. A newly-prevalent discourse was that teachers perceived a need to first ensure students' 'fluency' and basic mathematical knowledge, before engaging with such practices. On probing, 'fluency' was often still interpreted as quick, accurate recall of core facts and execution of core procedures, rather than the flexible and efficient choice and usage of key knowledge, as expected in the national curriculum.

The wider national curriculum includes learning for data and financial literacies. With the exception of one teacher, our teacher and student sample reported negligible mathematics lesson engagement with related topics, beyond a few aspects mentioned specifically in GCSE Mathematics specifications. Almost all participant teachers and students felt that a greater focus on both data and financial literacy would be beneficial for students in their personal, and later employment, lives.

Resources

There was little evidence of the printed and digital (Pearson) curriculum resources previously heavily used in four of the schools, and indeed, no observed use of any

printed or digital textbooks. In four of the five schools, the digital resource Sparx was used for most, or all, homework, and a variety of free or affordable other online resources were also drawn on for in-class use. Very little use was being made of manipulatives, either physical or digital, and students confirmed that was typical. Teachers often reported this was because of their limited confidence or skill to do so, exacerbated by in-pandemic lack of use.

Digital engagement beyond the leading Power Point remained usually very constrained, with little use even of digital interactivity or animation, for example. Apart from the use of web-based subject-specific materials incorporated into Power Points, and some elementary use of hand-held calculators, there was no observed use of digital tools for mathematical purposes. At least 15 of the 20 focus groups claimed they had not worked with spreadsheets (or specific versions such as Excel) in mathematics lessons or for mathematical purposes in other subjects; no students recognised having themselves worked with graphing software, although about a third said their teachers sometimes used graphing software in lessons. Apart from calculators, there was no student use of digital devices observed, and participants confirmed they rarely engaged in such use in school, with access to laptops or computer suites usually dominated by other subjects. Sample schools had mixed policy on whether students could use mathematical tools on their 'phones in lessons, but such use (and then, only superficial) was only seen in two of the 20 lessons observed. Occasionally teachers identified students' access to devices as an issue for the normative digitally-based homework, though students often reported sharing a 'phone to do homework, and that the cost of related data was sometimes an issue.

Pandemic legacy

Sample schools reported a pandemic increase in the use of digital tools for presentation and assessment, and in teachers' related skills. Use had often persisted, including in amelioration of teacher or student absence. However, there had been no significant change in the use of digital technologies for mathematical purposes, and in at least one school, a decrease in such use that was still persisting. Participants reported varying levels of student engagement during remote teaching, and unreliable formative assessment, so that both teachers and students often remained insecure in their knowledge of pandemic impact on mathematics learning.

Student absence remained an issue in pockets in all sample schools, and a serious issue in two of the five schools. In consequence, there remained widespread but unpredictable and patchy gaps in learning. Teachers reported that addressing most of these required persistent and long-term approaches. They evidenced a range of interventions to help close learning gaps – but on a scale of teacher commitment that we suggest is probably unsustainable. Coupled with a renewed sense of curriculum overload, many teachers felt there was little scope for supporting extra-curricular mathematics enrichment activity – or for developing their own skills and knowledge.

Student affect

Participants considered a range of affective issues were catalysed or exacerbated by the pandemic: poor mathematics self-concept, confidence, resilience, motivation, and often also, student mental health and anxiety issues. Some students were concerned that teachers might not be fully aware of the extent of those. Teachers reported that the range of such issues seemed to impact girls disproportionately. In response, teachers were working hard to build up more positive affective traits, but some issues

were proving fairly intractable. There were also, though, reports of occasional (and again, long-term) positive impacts, with some (and often, less confident or neuro-diverse) students appearing to have benefited from less structured routines or personalised support.

Assessment

Teachers reported an enhanced awareness of the need for ongoing and effective formative assessment (though were also aware of the demands of that, depending as it does on deep, detailed and flexible teacher subject and subject pedagogical knowledge). Mini whiteboards, group work and discussion were widely used for such purposes; also diagnostic questions and mini tests, from a range of usually online resources, in class and/or as homework.

Some students had positively appreciated the release of learning time when end of year 6 assessments were cancelled, and the strength of the consequent detailed 'student profiles' used to support primary to secondary transition; teachers also commented on the effectiveness of such profiles. However, both teachers and students reported a (re-)emerging hegemony of GCSE performance, and a renewed emphasis on maximising performance in such external assessments.

Commenting on the transitional arrangements made for the recent return to formal GCSE examinations, teachers and students had mixed responses to provision of formula sheets and of advance information: both groups perceived advantages to motivation and focus in providing advance information, but were concerned about the development of students' revision and examination skills. There was also some (re-) emergence of concerns around GCSE tiering and grade boundaries. However, no participants teachers suggested incorporating elements of in-pandemic approaches to summative assessments, in the long-term.

Stability of findings

It is of course difficult for participants to be confident about the stability of their approaches or experiences, but most felt that the rate of post-pandemic adjustment had slowed considerably, and saw no reason to expect imminent significant change.

Discussion and implications

What we see, then, is that in these five schools, pandemic impacts were still significant and requiring considerable attention, often at the expense of a reasonable work-life balance for teachers. Teachers were largely more digitally-confident than previously. However, there was no evidence of increased use of digital tools for mathematical purposes, although some web-based digital resources were heavily used as a medium for initial teaching or for homework. All sample departments had moved towards PowerPoint-led lessons, and away from the use of printed or digital textbooks: that change in resource use mirrors primary school findings in Marks et al. (2023). Such a move does not necessarily diminish the quality of teaching, although many of our observations evidenced teaching heavily constrained by presentations often prepared centrally, without even knowledge of the target class.

Concerningly, opportunity to learn mathematical problem-solving, reasoning, link-making, and communication was unusual in observed lessons. Participant reports did little to suggest observed lessons were unusual, suggesting such practice had sometimes deteriorated from pre-pandemic evidence. Further, GCSE assessments and

performance metrics appeared to support an impoverished curriculum interpretation. Reported increasing challenges with recruitment and retention of mathematically effective teachers, coupled with perceptions of increasing curriculum and assessment pressures, are likely to further constrain practice. Allied with a continuing-limited provision of mathematics education for data and financial literacies, we suggest that mathematics education for most of these students' future needs has, at best, stagnated. However, we note that in occasional instances, and more broadly in one school, teachers were able to teach in engaging and aspirational ways. In the latter context, such practices appeared to be supported by clear department leadership and establishment of a mathematically interested and discursive teacher community.

The study is clearly limited by the small number of cases considered, with no poorly-graded school included: one obvious implication for researchers is the need to establish how widespread such findings are. However, even if not ubiquitous, findings do raise questions for curriculum and assessment authorities, for teachers in schools, and for curriculum resource provision.

Acknowledgements
We are grateful to Pearson UK for funding this study.

References

Andrews, J. (2023). *Recovering from the Covid-19 pandemic.* EPI and Renaissance Learning. Recovering from the Covid-19 pandemic: Analysis of Star Assessments - Education Policy Institute (epi.org.uk)

Barrow, E., Golding, J. and Grima, G. (2021) 'It's been worth the effort': Primary school teachers learning to teach mathematics remotely during the pandemic. In Marks R. (Ed.) *Proceedings of the British Society for Research into Learning Mathematics 41* (2) June 2021 http://www.bsrlm.org.uk/publications/proceedings-of-day-conference/ip41-2/

Braun, V. & Clarke, V. (2022). *Thematic analysis: a practical guide*. Sage.

Committee of Public Accounts (2023). *Education recovery in schools in England.* Education recovery in schools in England (parliament.uk)

Golding, J., Redmond, B. & Grima, G. (2022a). *Power Maths Efficacy Study 2019-2022: Final Report*. Pearson UK.

Golding, J., Redmond, B., & Grima, G. (2022b). Primary children's perspectives on the roles of reflection, challenge and explanation in 'mastery' resource-rich classrooms. In Marks R. (Ed.) *Proceedings of the British Society for Research into Learning Mathematics 42* (3) November 2022 http://www.bsrlm.org.uk/publications/proceedings-of-day-conference/ip42-3/

Golding, J. (2021). Flexible learner or imposter? Learning A Level mathematics in England through the COVID-19 pandemic. *Teaching Mathematics and its Applications 37* (2), 98-112

Golding, J., Hooper, A., & Grima, G. (2018). *KS3 Maths Progress and GCSE 9-1 Mathematics - Implementation and effectiveness: Final report*. Pearson UK.

Marks, R., Barclay, N. & Barnes, A. (2023). *The prevalence and use of textbooks and curriculum resources in primary mathematics.*

Nuffield Foundation. Final-Report-The-Prevalence-and-Use-of-Textbooks-and-Curriculum-Resources.pdf (nuffieldfoundation.org)

Smith, D. E. (2005). *Institutional ethnography: A sociology for people.* AltaMira.