

Covid19 summer: Impacts on mathematics A Levels teaching, learning and progression

Ben Redmond¹, Jennie Golding², Grace Grima¹

¹Pearson, ²UCL Institute of Education

We report on ways that teaching and learning for mathematics A Levels, studied pre-university in England (by students aged 16-18), was disrupted by Covid19 in Summer 2020. Findings are contextualised within teacher and student accounts of the aspirational and time-pressured nature of these reformed qualifications. We explore the nature of engagement with mathematics achieved by year 12 and 13 students during lockdown, and the preparedness of 2019-20 year 11 and 13 students for progression into A Level/Higher Education respectively. Our findings derive from the third year of a four-year study (2017/18 to 2020/21) exploring enactment and impact of reformed mathematics A Levels, and efficacy of associated Pearson resources and assessments. Research tools were adapted to focus on impacts of Covid19. We present a snapshot (March to July 2020), of teachers and students looking to the future in a time of uncertainty and rapid change.

Keywords: reformed A levels in mathematics; impact of Covid19 on teaching and learning; teacher and learner experiences.

Introduction: the policy and pandemic contexts

Reformed A Levels in Mathematics and Further Mathematics, studied pre-university in years 12/13, were introduced in England from September 2017 as part of a wider qualification reform. They were developed largely top-down from Higher Education input (ALCAB, 2014), and were generally well-received by the subject community. They feature enhanced content-related scope and have a renewed focus on mathematical reasoning and problem solving as well as mathematical modelling. Their emphasis on mathematically important processes rather than superficial facts targets deeper engagement with mathematics (Golding and Smith, 2016). However, this often requires significant development of teacher pedagogy and subject knowledge. The greater depth/breadth of learning required has also created challenges for students. Both qualifications are, unlike their predecessors, assessed at the end of two years' study, increasing the 'high stakes' nature of their final assessment.

In March 2020, in response to Covid19, all schools and colleges ('centres') in the UK closed to most students. Examinations were later cancelled, to be replaced by centre assessed A Level grades. Schools and teachers had to formulate their response in a rapidly changing and unprecedented scenario. We report on ways that learning for mathematics A levels was affected by disruptions to teaching during this time. We contextualise this within teacher and student accounts of pre-existing challenges created by the aspirational and time-pressured nature of these qualifications.

The impact of school closures is poorly understood. Further, existing and recent evidence is largely of much shorter school closures, and (e.g. Drijvers, 2020) related to younger students. For example, we know disadvantaged younger students are likely to lose learning disproportionately (Education Endowment Foundation, 2020). Further,

even when teaching and learning are continued remotely, they are disrupted in a variety of ways when a remote interface is adopted (Ruthven, 2009).

Research questions and theoretical frameworks

This paper draws on the findings from the third year of a four-year study (2017-2021) carried out by Pearson in collaboration with UCL. In an effort to understand the lived experiences of teachers and students, we adopted an institutional ethnographic approach (Smith, 2005). Pearson provides both A Level assessments and resources to support learning for these assessments. The study sets out to understand the enactment and efficacy of Pearson’s reformed Mathematics/Further Mathematics A Levels and associated free/paid for resources. In summer 2020, research questions focused on those areas expanded in scope to capture emerging impacts of school closures and exams cancellation in response to Covid19:

1. What were teacher reflections on the mathematics experiences, use of curriculum and assessment resources, and impact on students in years 13, 12 (and 11 if applicable) through the school/college closure period to July?
2. What were teachers’ experiences of assessing A Level grades in line with given centre-led assessment protocols?
3. What were the consequent anticipated planning and support needs for Autumn teaching and learning?

We report here on responses to the first question. Data were also collected from year 13 students at the beginning of lockdown; related results are largely not reported here.

Methodology

As indicated in Table 1 which outlines data collection for the third year of the study, each yearly cycle comprises three phases, collecting largely primary data from 13 fairly representative centres. Each year included similar activities, involving Mathematics and Further Mathematics classes, usually from years 12 and 13. The data reported in this paper derives purely from Spring 2020 student and Summer 2020 teacher surveys. Standing alone, surveys are not ideal for institutional ethnographic purposes, but pandemic constraints precluded face to face data collection, and with well-established relationships with teachers already established, in this case they supported rich and often extensive responses.

Table 1: Data collection in year 3

Phase 1: Autumn 2019	- 33 Heads of Maths/mathematics teacher online survey responses (via telephone in year 1, to establish relationships) - 24 study class sets (years 13) of Mathematics grades at age 16
Phase 2: Spring 2020 (centre visits)	- 20 year 13 lesson observation notes - 18 teachers post-lesson interview transcripts - 15 year 13 post-lesson student focus group transcripts - 218 year 13 students online survey responses
Phase 3: Summer 2020	- 28 year 13 teacher online survey responses: many also taught years 12 and 11, and responded also in relation to them - 24 classes’ end of year progression assessment data

The sample of centres for this study was drawn from a small number of Pearson centres willing to participate. This restricts the extent to which outcomes are generalisable. However, participating centres featured reasonable variation in other aspects known to

affect teaching and learning, although previously low-attaining centres were somewhat under-represented. In each centre we collected data from the Head of Mathematics or person responsible for A Level Mathematics, and in the first year, from two year 12 classes and their teachers. In year 2 we expanded this to follow through those students into year 13, and to include two year 12 classes from the new cohort and their teachers. All interviews were recorded and transcribed; all qualitative data were then iteratively analysed by research question and then an open grounded approach (Charmaz, 2006) was used to expose grounded sub-themes. In parallel, documentary analysis of specification and assessment materials and of school 'schemes of work' and other local documents were analysed in an attempt to understand enactment with an 'institutional ethnographic' lens (Smith, 2005): survey responses could therefore be interpreted within a much wider grasp of centres' personnel, as well as in-centre and broader working context/constraints.

Findings

Earlier findings showed teachers were generally supportive of the more aspirational nature of the reformed specifications. However, they, and students, reported that the deeper engagement with mathematics and the greater emphasis on problem solving and reasoning have put additional pressure on students:

I personally like it as a mathematician: it is nice to combine skills and do more problem solving and modelling. Students are definitely not prepared for [problem solving and reasoning]. *School 5, Initial teacher survey.*

Teachers observed that the increased depth and breadth of content in the reformed qualifications have also accelerated the pace of teaching and necessarily, learning, placing greater emphasis on students' capacity for independence. Teachers reported many students were already struggling to engage in meaningful independent learning:

I see a lot of them, but they have to cover twice as much stuff. So if they're not spending lots of time every week, then they will fall behind very quickly. *Centre 12, Teacher 1, Post Observation Interview.*

I'm really worried about some people's ability to have any sort of independence outside school and do any sort of independent work... 'cos some of them just aren't doing the work. *Centre 6, Teacher 1, Post observation interview.*

This is likely to have been exacerbated by centre closures, particularly where students lack access to digital devices or to adequate spaces for home study:

There will be a greater emphasis on independent learning. Students with difficult technology access/insufficient technology provision will have to be further supported. *Centre 6, Teacher 2, End of year survey.*

Time for synthesis and consolidation of learning has also been 'squeezed' by the new A Level. Teachers felt this usually concentrated in the final weeks of the course, and was therefore likely to have been further impacted by centre closures:

Students probably missed out on a lot of consolidation and revision which they definitely would have done in preparation for the exams, which eventually did not happen. *Centre 4, Teacher 1, End of year survey.*

During lockdown, teachers reported very little interaction with year 13, particularly once all topics had been covered, and little monitored work was expected:

Initially focused only on practice papers however stopped setting work following announcement of cancelled exams. *Teacher 1, Centre 2, End of year survey.*

The exception to this was two general Further Education ('FE') colleges, which maintained live interactions and selective feedback until the end of May 2020.

After the college closure, Year 13 were set 4 exam style questions...for submission via Turnitin on their...virtual learning environment...where teachers provided detailed feedback on strengths and identified areas for improvement. *Teacher 1, Centre 12, End of year survey.*

Where work had been offered to year 13 students, it typically drew on their usual (printed or digital) textbooks and exam papers, sometimes supplemented by a small range of websites. Participation from year 13 students had usually been limited and often poor, and most teachers expected there to be significant negative impact on the skills and knowledge taken to subsequent stages in their education, particularly for those enrolling on courses which require in-depth mathematical knowledge and skills:

This cohort will largely go onto uni with maths skills noticeably lower than those of previous years. *Centre 10, Teacher 1, End of year survey.*

There were small groups of year 13 students thought to have benefited: the highly motivated and organised, and those preparing for (additional) papers.

Yes, especially staying at home has given me the flexibility to keep on top of my work and study topics that I found fairly challenging compared to others. *Student, Spring survey.*

However, this individual represented a small minority: most reported feeling their learning had been significantly negatively impacted.

In contrast, most teachers had attempted to maintain teaching of year 12 following centre closures, though synchronous online provision was unusual:

We set a normal amount of work per week, remotely, which was set and monitored by a member of staff. The students did remote tests and assessments and submitted their scores. *Teacher 2, Centre 7, End of year teacher survey.*

Many teachers experienced some small-scale 'live' contact with year 12 students as the summer term progressed, and most expected to have seen some of these students face to face at least once before the summer break. Teachers monitored submitted work from year 12 students in ways that were generally felt had been effective, but student engagement had been variable. Most teachers expected to find significant and diverse learning gaps in this cohort come September 2020. Resources for year 12 students focused on textbooks and exam papers, plus additional websites that sometimes included monitoring and assessment features.

Input required from year 11 students varied, but it was unusual for teachers working in 11-18 centres to expect lockdown work from all year 11 students:

We set bespoke programmes, but we don't know how much they participated. They could send work in if they wanted to, but most didn't. *Teacher 1, Centre 9, End of year survey.*

However, over half of year 11 teachers had provided work targeted at those students intending to take mathematics A Levels in mathematics, although the scale, scope and monitoring of this work varied significantly:

(We set) bridging unit for those students considering studying A Level Maths. *Teacher 1, Centre 6, End of year survey.*

Other teachers reported that they expected no work from their year 11 students:

None. The school decided that we wouldn't ask year 11 to engage in work in any subject. *Teacher 2, Centre 3, End of year survey.*

Year 11 Student participation in work which had been set was mixed and there had been little formal assessment of related learning. A wide range of resources had been used for such purposes, including commercial and free printed materials, free online transition resources and centre-developed materials. Most teachers expected significant gaps in depth and fluency of GCSE Mathematics knowledge, particularly for those students going onto take A levels in mathematics:

I am not confident that many did any learning over the closure period. I have not seen any from my year 11 class. *Centre 10, Teacher 2, End of year teacher survey.*

Some teachers planned additional formative assessment for the incoming year 12, usually within a ‘business-as-usual’ framework, with most centres not planning significant changes in teaching; others, at the data collection point, had not yet put plans into place for these students:

Run extra sessions after school for students struggling to make the transition. *Centre 6, Teacher 1, End of year survey.*

I don’t know! We don’t really have much of a plan for dealing with this at the moment. *Centre 13, Teacher 3, End of year teacher survey.*

These data were collected before the summer break: data from Autumn 2020 onwards will evidence approaches to teaching and learning as the longer-term impacts of the Covid19 pandemic become clearer.

Discussion

Evidence presented in this paper indicates that almost all mathematics A Level and pre-A Level students’ learning was to some extent likely to have been affected by disruptions to teaching in summer 2020. This disruption varied across centres and across year groups, with little monitored work expected from year 13 students, more usual patterns attempted for year 12 although usually asynchronously, and variable approaches taken to year 11 students approaching mathematics A Levels. Engagement, though had typically been disappointing across year groups. This evidence is in contrast to that in some other jurisdictions, e.g. Flanders, Germany and the Netherlands (Drijvers, 2020), where synchronous provision was widely adopted from early on in the pandemic. Our evidence places this disruption to learning in the context of the aspirational nature of these reformed qualifications. Although teachers’ comments suggest that the greater depth of engagement with mathematics that the reformed qualifications require from students has the potential to create better mathematicians, this was also seen as putting considerable pressure on both students and teachers. In this high-stakes environment the additional challenges created by Covid19 may have substantial impacts on students’ learning and progression.

Teachers indicated that the more aspirational qualifications have resulted in an accelerated pace of delivery; the breadth and depth of content to be covered means that reduced time is available for synthesis of learning. School closures are likely to have further impacted students’ ability to consolidate their learning, which typically is concentrated towards the end of the year. The reformed qualifications also place a greater emphasis on students’ independent learning. Our evidence suggests that many students were struggling to develop requisite independent learning skills and practices. Centre closures are likely to have intensified these pressures and created considerable impact on learning for many students.

Unsurprisingly, then, most teachers projected a significant deficit in learning brought from A Levels. Where students intended to progress to university courses with

strong mathematical prerequisites, there was a concern from teachers that this would create a significant barrier to confident progression. Year 12 students in participating centres had benefited from monitored work set by teachers, but their response to this had been variable and most teachers also expected to find significant learning gaps in this cohort as they progress into the second year of A level. Similarly, in the year 11 cohort, most teachers expected significant gaps in depth and fluency of mathematical knowledge to be evident as students embark on post-16 education. In this study they were particularly concerned where students are embarking on mathematics A levels. Many teachers planned additional formative assessment for such incoming year 12 students. However, this intervention was usually envisaged as taking place within a 'business-as-usual' framework and without significant adjustment to main teaching, in part since the demands of the reformed A Levels were perceived not to accommodate any significant adjustment to pace or depth of demand.

These student cohorts will need ongoing support to enable them to progress, tailored towards gaps in their skills and knowledge which are specific to each year group and likely to vary across centres. Teachers have also been put under considerable pressure by disruption related to Covid19 and say they need bespoke resources to help identify and resolve gaps in students' knowledge. Further research will be key to identifying and providing for students' and teachers' needs. This study will continue probing these areas in a fourth year, as teachers and students continue to respond to the emerging educational impacts Covid19.

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