



MATHEMATICS A LEVELS: REFLECTIONS AND EXPERIENCES IN A PANDEMIC SUMMER

March-July 2020

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This report draws on two main data sources. First, it cites data from the third year of a Mathematics A Levels study ('the maths study') conducted by Pearson UK Efficacy and Research team in conjunction with UCL Institute of Education. That study asks what impact Pearson A Level Mathematics and Further Mathematics specifications, resources (free and paid-for) and summative assessment provision are having on young people and serendipitously was able to capture information on teacher and student experiences and reflections March-July 2020. Relevant data, from our now-well-known 13 centres, comprised

- 218 participant year 13 student surveys from March-April 2020
- 28 participant year 13 teacher surveys from July 2020, almost all of them pleasingly detailed.

In May 2020, Pearson Efficacy also conducted cross-curricular teacher/student research ('the cross-curricular research') focusing on production of centre assessed grades (CAGs) and ranking, that resulted in, among other data,

- 13 recordings of interviews with Heads of Mathematics
- Surveys from overlapping groups of 68 GCSE Mathematics and 44 A Level Mathematics teachers
- Surveys from 91 year 13 A Level Mathematics students.

Spring/Summer 2020 Experiences:

- **Centre closure for year 13:** Teachers generally reported very little monitored work expected from year 13, especially once all topics had been covered. The exception was two FE colleges, which had maintained live interactions and selective feedback until the end of May 2020. Where work had been offered, it typically drew on Pearson textbooks and exam papers, sometimes supplemented by a small range of websites. Participation had usually been limited and often poor. Most teachers expect there to be a significant negative impact on the skills and knowledge year 13 students take with them. However, there were exceptional small groups of students thought to have benefited: the highly motivated and organised, and those preparing for STEP.
- **Centre closure for year 12:** In contrast, most teachers had attempted to maintain teaching of year 12, though synchronous provision throughout was unusual. They had monitored submitted work in ways they generally felt had been effective, but student response had been variable, and most teachers expected to find significant, and a wide range of, learning gaps come September. Resources focused on textbooks and exam papers, plus additional websites that sometimes included monitoring and assessment features. Students were usually already familiar with these. Many teachers experienced some 'live' contact as the term progressed, and most expected to have seen some, though not all, students face to face at least once before the summer break.
- **Centre closure for year 11:** 18 study teachers worked in 11-18 centres. Just three reported expecting post-closure work from all year 11 students. Another ten had provided for those intending to take mathematics A Level(s); scale, scope and monitoring within that varied significantly. Student participation in, and commitment to such transition provision, had been varied. There had been little formal assessment of related learning. A wide range of resources had been used for such purposes, including Edexcel A Level materials, CGP and free online transition resources, and centre-developed materials. Most teachers

expected significant gaps in depth and fluency of GCSE Mathematics knowledge, and they often planned additional formative assessments for the incoming year 12, usually within a ‘business-as-usual’ framework.

- **Teacher experiences with CAGs:** 27 mathematics study teachers had inputted to student CAGs, sometimes responding to a centrally-produced initial list. The cross-curricular research included 13 Heads of Mathematics and 44 teachers of A Level mathematics, who generally felt satisfied with their level of involvement, well informed (though not always at an ideal time) and reasonably supported. Centres had drawn on a wide, and sometimes exhaustive, range of existing data, sometimes supplemented by ‘professional judgment’ and observed approaches to work. Nine of twelve mathematics study centres had somewhat moderated draft CAGs to better align with historical performance, though a few teachers in both studies also reported centre pressures to inflate grades. Teachers across studies found ranking more difficult than grading, although D/E grades were difficult to distinguish. They were almost all at least moderately confident about the outcomes of both processes for mathematics A Levels, feeling they were the fairest achievable, but generally felt late-developing, or late-working, students, among others, might be disadvantaged. There was little confidence in CAGs produced for AEA. Compared with teachers of other subjects, mathematics teachers drew on more data, more thoroughly, and CAGs moderation was perhaps easier. They pointed to the emotional demand of producing high-stakes grades, and had concerns about inconsistency within departments and schools, as well as across centres.
- **Student experiences with CAGs:** The mathematics study evidenced some related student and parent interactions, but no significant issues. Students in the cross-curricular research said they felt reasonably informed about CAG production by their centres, though many had also made independent enquiries. Perceptions of fairness of the process varied, with many frustrated at the lack of opportunity to demonstrate what they could do.
- **Centre plans for Autumn 2020:** In July, about half of study teachers did not have clear plans for Autumn teaching. Many were preparing for dual routes, or for some form of blended learning, with variable balances of face to face and distance teaching, although some expected ‘business as usual’. Nearly all anticipated challenges in assessing and addressing gaps in learning, and while that was more pronounced for the incoming year 12, building on GCSE grades of unknown robustness, there were concerns about time pressure for year 13. Planned responses were largely around additional interventions and tweaks to pedagogy, with perceptions of little scope for major changes. Teachers requested additional secure assessments, and further provision of new-style questions.

FORWARD PLANS

The challenges of the pandemic have clearly been considerable for both teachers and students in centres and Awarding Organisations. Looking forward to 2020-21, in a very volatile educational context, we propose asking:

1. **Enactment of new specification:** *How, and to what extent, are specification intentions being reflected in learning opportunities in the present circumstances? (especially problem solving, reasoning, modelling, large data set) Are there areas of mathematics it has been particularly difficult to teach/learn in the current context, or when teachers and/or students are working remotely? Have there been positive impacts of remote learning for teachers or students, and if so, what?*

2. **Teacher preparedness:** *Do teachers have access to suitable (subject-specific or other, Pearson or other) preparation for teaching the mathematics A Levels in the current contexts?*

3. **Participation:** *Who is participating in mathematics A Levels this year, and has that changed?*
4. **Progression:** *What mathematical and working foundations are students bringing to this year, and how are teachers finding that out? How does that compare with historical preparation? How are student trajectories responding to disruptions – likely participation in STEM post-18? Any feedback they have from the previous year 13 regarding the impact of centre closures on their trajectories? For HEI mathematics and mathematics-using departments, what is the robustness of the progression base from mathematics A Levels for students in the 2020 A Level cohort, and how do they know? How does that compare with the preparedness of the previous cohort?*
5. **Resources:** *which (free and paid-for) resources are teachers and/or students using to support their mathematics A Levels work in the current context, and how? How are teachers and students proposing to use the Edexcel Pearson free assessment surround this year?*
6. **Impact on student learning:** *How do teachers anticipate the medium-term impact of the disrupted year 11/12 and likely-disrupted year 12/13, on students' grasp of A Level knowledge, skills, processes and concepts? Are all learners currently having the opportunity to develop and demonstrate their mathematical skills and knowledge in ways which are consistent with the specification? Are students being able to acquire the mathematical skills, knowledge and affect to progress to appropriate routes post-A Level?*
7. **Summative assessment:** *What are teachers' retrospective views on the reliability and validity of CAGs for mathematics GCSE and A Levels? How do teachers and students think students would respond to the current proposals for Summer 2021 A Level assessments? Are they confident about what is proposed, and that it would provide a valid and reliable measure?*

1 BACKGROUND

The A Levels that are the subject of this study were part of an overhaul of A Level qualifications that resulted in a staggered introduction of 'more aspirational' A Levels. For A Level Mathematics, the entire content is 'core', with a greater emphasis on genuine mathematical problem solving, on proof, and on mathematical modelling, all consistent with the renewed emphases in the new GCSE examinations at age 16. A new feature is that all students are expected to engage with technology to analyse and become familiar with a large data set, and to be examined on their grasp of that. Pearson Edexcel is unique in assessing all Applied content (a mix of statistics and mechanics) in the third of three papers, the other two being entirely composed of Pure Mathematics content. AOs were also able to devise their own Further Mathematics curricula beyond a 50% Pure Mathematics core. In Pearson Edexcel's case, the Further Mathematics curriculum consists of 50% core Pure, plus 50% over two papers in one or two of Further Pure, Further Mechanics, Further Statistics, or Decision Mathematics. Students may take extra papers and 'count' the best of those options for their final grade. Taken together, these features represent significant changes for this high-entry subject, so Pearson, in conjunction with UCL, are monitoring enactment and impact in a longitudinal, classroom-lose study that draws heavily on teacher and student experience and voice.

Introduction of the new mathematics A Levels has proved demanding and teacher confidence in teaching and assessing for it, fragile. Summer 2020 proved even more demanding, with students out of school from late March, centres usually unprepared and under-equipped for distance learning, and teachers required to assess and rank year 13 students to feed into summative assessment algorithms. Serendipitously, this study has been able to evidence some of the teacher and student responses to learning and assessment during the pandemic (though not, as planned, to evidence their responses to a second large-scale enactment to fruition of the new specifications), but Pearson also in May 2020 undertook cross-curricular research probing teacher/student perceptions of the CAG- and rank-producing process. This report focuses on mathematics A Level teacher and student responses to their March-July experiences, drawing on both studies. Further details of the mathematics study can be found in Golding, Redmond and Grima (2020)¹, and of the cross-curricular study in Redmond et al. (2020). In the event, there was in August 2020 a change of approach that eventually saw students awarded centre-assessed grades, resulting in significant changes in results profiles, with associated challenges. Mathematics A Level teacher and student responses to that will be sought in Autumn 2020, as part of a one-year extension to the mathematics A Levels study.

2 METHODOLOGY

Details of the methodology adopted for the mathematics study as a whole are reported in Golding, Redmond and Grima (2020, op.cit), including the sample and research tools; further details of the cross-curricular study in Redmond et al. (2020)²

In the third year of the mathematics study, data were collected from 13 centres preparing students for Edexcel Pearson A Level examinations: nine schools and four colleges, and two year 13 classes in twelve of these - from teachers and students in 15 Mathematics A Level classes and 9 Further Mathematics A Level classes, together with the Head of Department and/or Head of Key Stage 5 provision where those

¹ Golding, J., Redmond, B., & Grima, G. (2020). *A Levels in Mathematics: Implementation and Effectiveness of A Levels first taught from September 2017. Third Interim Report*. London: Pearson UK.

² Redmond, B., Barrow, E., Hill, J., Nyamundanda, E., Hooper, A., & Grace, G. (2020) *Experience of the Summer Series 2020*. London: Pearson UK.

were different. These centres have a variety of characteristics known to impact teaching and learning, and are slightly skewed to higher student attainment at A Level. They make varied use of free and paid-for Pearson resources and all enter the Edexcel Pearson A Level Mathematics/Further Mathematics examinations. In combination, these variables mean it is not possible to generalise from the detailed findings with any confidence; however, findings are likely to be indicative of wider trends, especially as Pearson dominates the Mathematics A Level market.

Our mathematics study Spring year 13 survey serendipitously captured some very early student responses to the lockdown, though it was not specifically designed for this purpose. It was initially launched prior to lockdown and was designed to capture experiences and responses over the whole course. In the event, we were able to edit the survey slightly to ask about the use of resources over that period. The Summer 2020 teacher survey was redesigned to focus on probing teacher responses to their experiences of teaching, and of students' learning over the lockdown period, with a focus on years 11, 12 and 13; it also probed their experiences and reflections on the experience of producing centre-assessed grades (CAGs), and their initial planning for an at least partial move back into centres in September 2020.

As indicated above, the study was adapted in late Spring/Summer 2020 to answer the following research questions:

1. *What are teachers' reflections on the mathematics experiences, and use of curriculum and assessment resources, of years 13, 12 (and 11 if applicable) through the school/college closure period to July?*
2. *What do they perceive the likely impacts of school closures (positive and negative) on year 11, 12 and 13 mathematics students from the evidence available to them at that time?*
3. *What were teachers' experiences of assessing A Level (and AEA) grades in line with centre-led assessment protocols?*
4. *What are their planning and support needs for anticipated Autumn 2020 teaching and learning?*

We drew on 218 participant year 13 student surveys (mid-March to late April, 2020), and 28 participant year 13 teacher surveys (July 2020), to do so. Our experience has been that as we have deepened our working relationships with teachers and students over this longitudinal study (three years to date), summer surveys have come to provide unusually deep and detailed responses from both teachers and students, and we are grateful for their generosity of time and reflection for those purposes.

In parallel, Pearson Efficacy and Research team ran cross-curricular teacher experience research focused on the production of CAGs in May 2020, with interviews on Microsoft Teams with 75 heads of departments (15 in the pilot study and 60 for the main research study). The research tools were designed to help Pearson better understand the experiences of Heads of Department during the process of providing predicted grades and a rank order for their students. Pearson intended to use this information to ensure that the system of centre assessed grades, which replaced the cancelled examinations, was as fair as possible. They also ran surveys for A Level teachers, and for year 13 students. These tools resulted in responses from 13 Heads of Mathematics, overlapping groups of 68 GCSE Mathematics and 44 A Level Mathematics teachers, and 91 Mathematics A Level students. The representativeness of the source centres is not known in any detail.

Throughout this report, quotations are referenced as follows:

HoD: Head of Department
CPD: (teachers') continuing professional development
y12: Year 12
y13: Year 13
C3: Centre 3 in the mathematics study
FM: Further Mathematics
Ma: Mathematics
AMSP: (DfE-funded) Advanced Mathematics Support Programme;
T2: teacher 2
EoYS: End of year (June/July) teacher survey
S74 Spring S: Student 74 in the March year 13 survey
GR HoM: May 2020 cross-curricular research Head of Mathematics interview
GR SS: May 2020 cross-curricular research student survey response
GR TS: May 2020 cross-curricular research teacher survey response

3 FINDINGS: EXPERIENCES, USE OF MATERIALS, AND PROGRESSION MARCH-JULY 2020

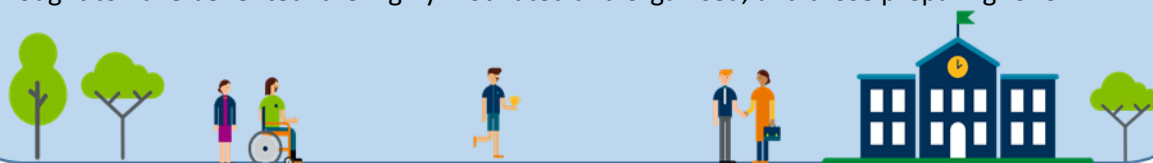
We report on first, centre approaches to work and resources over the closure experience, for years 12 and 13 and, if appropriate, 11; second, teacher experiences of assessing student A Level and AEA grades, and lastly, their plans for Autumn term teaching and learning. Responses are based on 28 teacher responses, from 13 centres, including in each case those from the Head of Department or other teacher responsible for mathematics A Levels. Although most of the 218 year 13 student survey responses were completed after centres had closed for lockdown, it closed before details of centre-assessed grading had been finally confirmed. Where students occasionally referred to what were then fairly new working conditions, and even more recent perturbations in examinations caused by lockdown, those are included in the appropriate section below. Sections 3.1 to 3.3, and 3.5, draw exclusively on data from the mathematics study; Section 3.4 draws additionally on mathematics-related data from the cross-curricular research conducted by the Pearson Efficacy Team in May 2020.

3.1 APPROACHES TO WORK AND RESOURCES FOR YEAR 13 STUDENTS

Teachers generally reported very little monitored work expected from year 13, especially once all topics had been covered. The exception was two FE colleges, which had maintained live interactions and selective feedback until the end of May.

Where work had been offered, it typically drew on Pearson textbooks and exam papers, sometimes supplemented by a small range of websites. Participation had usually been limited and often poor.

Most teachers expect there to be significant negative impact on the skills and knowledge year 13 students take with them. However, there were exceptional small groups of students thought to have benefited: the highly motivated and organised, and those preparing for STEP.



3.1.1 WORK EXPECTED OF YEAR 13 MATHEMATICS AND/OR FURTHER MATHEMATICS STUDENTS POST-CLOSURE.

19 of 28 teachers reported that either no work had been set once exam cancellation was common knowledge (ten teachers), or else that they had set work to be done after that but had not expected any feedback or communication with students thereafter (a further nine teachers).

'As this happened straight after mock exams, we covered the content that was poorly answered via Google Classroom. In addition, they were asked to complete additional activities on Integral, Desmos and Integral Maths. We stopped posting assignments in time for their summer exams' (T2 C1, EoYS);

'Initially focused only on practice papers however stopped setting work following announcement of cancelled exams' (T1 C2, EoYS);

'Year 13 kept going for 2 weeks up to Easter to complete the teaching of the course. We just had a few Statistics lessons to finish. After Easter we stopped contacting them' (T1 C13, EoYS);

'We did not ask them to engage with any work after school closed' (T2 C7, EoYS).

The remaining nine of 28 teachers reported a more proactive use of the time now available for different purposes than usual:

'FM: We finished the course content with them through the use of videos and the textbook. Participation wasn't 100% though as students were knocked by the knowledge that there were no exams. We did set some papers for revision to help them be ready for Uni (or the potential Autumn exams) but after this we stopped setting work and just made past papers etc available. Maths: Very similar for Maths we made sure we set work/lessons to complete the content - this took us to Easter. After that we made resources (and support) available to our students' (T2 C13, EoYS);

'We continued according to the timetable to deliver all the lessons to the end of May. We used Microsoft teams, set up classes and week before lockdown we explained how the lessons will continue online. With few initial small issues we had an amazing attendance and all students continue attending online lessons. We completed the specification (completed mechanics and statistics) and managed to practice a range problem solving questions including recap of pure maths' (T1 C8, EoYS);

'We ensured that we finished the syllabus, but after that encouraged them to keep up with continuous revision' (T2 C9, EoYS);

'As the "pure" teacher, I asked them to move through the last of the content that we had not yet covered. I prompted them to use the textbooks, watch the video clips of examples and then try the mini tests that I sent over to them online. About half the class engaged with this initially, sent me back their written work using their phones and then I would mark these and give feedback. I also recorded 3 video lessons. 1 on the missing content we did not cover, and 2 based on the requests of them. I am planning (hopefully this week) to prompt all those looking to do maths/engineering/physics related degrees next year to try the "university transition" module produced by AMSP on integral. I have also put a lot of time into helping a student with her STEP 2 and 3 preparation, via email' (T2 C10, EoYS);

'After the college closure, Year 13 were set 4 exam style questions (2 pure, 1 stats, 1 mechanics) for submission via Turnitin on their learnzone page (virtual learning environment) where teachers provided detailed feedback on strengths and identified areas for improvement. When setting a full paper, students were asked to self-assess before submission and identify 2-3 questions which they wanted feedback on. This helped to manage the workload of teachers. For the remaining subject content, 2 voice-over PPTs were provided each week and also contained suggested exercises to practice. Any difficulties with these could then be addressed in the support sessions via Microsoft Teams' (T1 C12, EoYS);

'We continued as usual, but online. We had the usual lessons and timetable, but shorter lessons with gaps between, to recognise the different pressures for students and teachers. For year 13 our emphasis was more than usual towards what students need to learn thoroughly and build on for next year, though we did ask them to complete A Level papers. They responded really well, and I think some of them learnt more productively and with a better sense of purpose, and use to them, than they normally do, when everything's about the exams' (T1 C5, EoYS).

Interestingly, those students whose teachers reported finishing coverage after lockdown, and who completed the survey late, made no comment around the mode of working in the last part of the course.

3.1.2 CURRICULUM AND/OR ASSESSMENT RESOURCES DRAWN ON FOR EXPECTED YEAR 13 WORK

The 18 of 28 teachers who had made either general suggestions for work, or more structured support and expectations, commonly referred to Pearson textbooks, digital or printed or unspecified versions (16 references) and/or to past exam papers or other assessment support sourced from Emporium (14 references). The others referred to a variety of supplementary resources, usually available online:

'We have subscriptions for them to use Kerboodle and Activelearn. We also linked videos from you tube' (T3 C13, EoYS);

'We made all the exam board papers available to them with mark schemes and highlighted video solutions where available. We also talked about the textbook mixed exercises and practice papers. In terms of lesson content we used tmaths.com and other youtube videos' (T2 C13, EoYS);

'We chose to use Turnitin on Learnzone and used exam questions from different sources e.g. Naiker Maths, Crash Maths, Pearson for assessment submission. The remainder of the content was guided by Dr Frost PPTs and adding a voice-over to these, along with supporting material already on the Learnzone page' (T1 C12, EoYS);

'Google classrooms was used to provide a past exam questions, powerpoints and links to online videos. Textbooks. I have since discovered that the animation of powerpoints does not work on GC so some had to be heavily revised to make them suitable' (T1 C10, EoYS);

'They were given plenty of links and suggestions about things to read or online courses to study' (T1 C4, EoYS);

'Topic papers and exams papers that I supplied from Maths Emporium/Pearson's website' (T1 C3, EoYS);

'2019 past papers, Integral Maths topic tests and exercises, Collated question from old spec FP2 (I took these from PhysicsandMathsTutor), MadasMaths practice papers' (T1 C1, EoYS).

As might be expected, reports from students in the spring survey reflected this range of resources. They were asked to identify what resources had worked particularly well for them during centre closures, and what challenges they had experienced. There was little new in the first, although some students (at least 8 of 2018) clearly valued individual centre input:

'Mathsnet & the videos on the college study directory helped me a lot to understand the method for attempting questions' (S98, Spring S);

'I think the videos used are very helpful and also my teacher has always been there to answer questions I have' (S152, Spring S);

'My college's own study directory and maths A level videos' (S31, Spring S).

Others (at least 16) said they had not engaged with work while at home:

'I haven't done work since school closed down. I think I have over worked myself and it's all too confused a situation so I took a month off' (S167, Spring S);

'I haven't done any: think we still should have had taught lessons if they wanted us to be committed to our work' (S178, Spring S);

'I like how you assume that we've been working – there seems little point really' (S108, Spring S).

A few students, though, appeared to have embraced the situation:

'I have been a lot of Madasmaths papers as these are relatively harder than other online that I have found. I also use Physics and Maths Tutor as there are explanatory videos and questions ranging from Super Easy to Exceptionally Difficult' (S102, Spring S);

'I used a lot of online resources but I am particularly fond of the online lessons we were provided from an external party. They provided increasingly difficult content with increasingly difficult examples which helped me to apply the concepts I was learning progressively' (S194, Spring S);

'I have used the Pearson digital book and I have been using past papers to assess my progress and understanding of topics. That has worked well' (S61, Spring S).

In terms of challenges to that work, resource-specific difficulties were centred around glitches in answers or solutions (at least 30 students, or 14%), inability to understand, or confusion over, solutions or answers given (at least 6%), limited digital textbook functionality (at least 4%) and still, unreliability, or slowness, of internet access (at least 25 students, or 11%):

'The lack of input. If you don't understand it despite watching videos and reading textbooks, then it's tough luck' (S94, Spring S);

'Often these textbooks (CGP and Pearson both) don't go into enough details sometimes. It would be nice to read about the proofs behind stuff we learn about (even if it isn't required for the exam) as I think it aids understanding very well, and in normal times you can ask your teacher' (S107, Spring S);

'The online textbook doesn't always work properly. I am guessing that when lots of people try to access it at once, it crashes, so it is always a bit of a hit or a miss as to when I get to do my maths work' (S89, Spring S);

'WiFi connection sometimes does not allow the pages of the books to load' (S82, Spring S);

'Submitting homework was a bit longer, and microphone issues/connection issues were present more frequently than expected' (S68, Spring S);

'Sometimes, the digital version is not updated (mark scheme was wrong/didn't match up with question or a whole topic is missing such as integration with parametric equations)' (S64, Spring S);

'The only challenge is it requires wifi and there isn't an offline version so when I don't have wifi (part of most days) I can't use it' (S59, Spring S);

'There were sometimes errors/discrepancies between the questions and the solutions, or different versions of the textbooks with different solutions' (S3, Spring S);

'Sometimes its down or I don't understand what the solution has done' (S5, Spring S);

'Scrolling 300 pages, a search function would be much easier' (S133, Spring S);

'Scrolling to the pages you need. There should be hyperlinks on the contents page if possible' (S14, Spring S).

Beyond resources, though, at least 23 students (11%) instead pointed to bigger issues that made it hard for them to thrive academically during centre closures:

'Resources are fine, not being in a classroom makes it difficult to focus though' (S129, Spring S);

'Getting distracted online - I try and do as much of my independent learning offline as possible' (S36, Spring S);

'The motivation to continue to study' (S41, Spring S);

'I think the most challenging thing is not having a teacher to sit next to you and talk you through something step by step' (S152, Spring S);

'Motivation and actually I want to still be taught but it's half hearted and we are expected to teach our self topics that we've never seen before' (S78, Spring S);

'The lack of input. If you don't understand it despite watching videos and reading textbooks, then it's tough luck' (S94, Spring S);

'They're (the resources) not really teaching you what to do, you kind of already need to know what your doing' (S38, Spring S);

'Being given big packs of work or vague amounts of work to do can be very demotivating and often suffocating to work through. I never did well when I had to do a chapter of work or "just study calculus"' (S194, Spring S);

'Less access to teacher help' (S92, Spring S);

'I have not struggled with using any online resources, the main issue is finding motivation to study by myself' (S83, Spring S);

'Actually doing work at all, since I don't have anywhere to study because my mother works from home at the only desk in the house' (S76, Spring S);

'Trying to understand topics myself because sometimes I would need a teacher to teach me the lesson rather than reading from the book that doesn't clarify everything' (S161, Spring S).

While the numbers homing in on each particular challenge might seem relatively low, students are focusing on, usually, one key aspect for them, so the numbers are very much lower due to the difficulties experienced. These young people are relatively experienced, and at the time of completing the survey, most were about six months from going to university. They had been nurtured mathematically in schools and colleges until this point, and appeared to have plenty of resources they could draw on, and in which they, broadly, had confidence. However, working mathematically at a distance was clearly demanding for very many of them, and not a panacea in this pandemic period.

3.1.3 SYNCHRONOUS CONTACT WITH YEAR 13 STUDENTS SINCE CENTRE CLOSURES

22 of 28 teachers reported having had no 'live' contact with students since school closures: common justifications given, in roughly equal measure, were the centre being wary of safeguarding issues, and the fact that exams had been cancelled, so there was no need. Two teachers at a general FE college had conducted synchronous lessons until usual pre-A Level study leave time in mid-May; three others at general FE colleges reported an eventual move to offering individual support sessions:

'Our college initially recommended that we didn't do live lessons with our students (concern with child protection issues), but we successfully used MS Teams with our international student courses, and

have since used Teams to deliver live lessons, including support sessions, to year 12. Year 13 have been invited to join in support sessions (informal live 'meet ups' where students can bring questions or suggest topics to review), but by this time most had finished the course content and had other priorities' (T1 C12, EoYS).

One other centre had offered individual 'phone calls home, related to particular issues.

3.1.4 MONITORING AND ASSESSMENT OF YEAR 13 STUDENTS' WORK

Ten of 28 teachers said they had not attempted to monitor any work after school closures:

'We haven't. The school did not want this work to affect the grades predicted for students' (T2 C3, EoYS);

'We haven't - as soon as it was announced that there would be no examinations, we considered the course complete' (T2 C7, EoYS);

'Once the announcement was made that exams were cancelled we no longer asked for submitted work. Prior to that we collected a homework as normal using showbie (this is something we use anyway)' (T2 C11, EoYS).

A further 6 of 28 teachers said they had used Google Classroom for the submission of work, and the other ten reported a range of proactivity and success in their responses, from more thorough assessment than usual, to fairly minimal, and sometimes constrained by student access to technology:

'Dr Frost has feedback facility' (T1 C6, EoYS);

'I have given them opportunity to contact me but have had no acknowledgement of work set or any communication from pupils about it. I've met a couple out and about but they were not really interested in talking about maths other than trying to get me to tell them what grade I had submitted for them or whether they should go to uni or not next year!' (T1 C10, EoYS);

'Questions were asked via email and teachers responded to individual pupil queries' (T1 C2, EoYS);

'This was the most difficult part of the remote learning/teaching. We were not allowed to see students on the screen so students presented their work during lesson by sharing a picture of their work. We also used 4 assessment (feature in teams) where students uploaded the work. This wasn't that successful as some students were using only mobile devices and some were struggling with the logistics (few just ignored the work)' (T1 C8, EoYS);

'Ask one to one questions during lessons and check answers on small tasks set up during lessons. Mark homework later on and give feedback' (T2 C8, EoYS);

'After students submit their work, feedback is added through Turnitin to give details on the strengths and areas for improvement for each student. Where more questions were set, self-assessment was used prior to submission, and students identified questions they wished to have feedback on. Students also indicated how challenging they found the paper and whether they needed to use notes to support their solutions. Worked video solutions were also provided afterwards to support the learning/feedback process further' (T1 C12, EoYS).

3.1.5 EXPECTED IMPACT ON YEAR 13 MATHEMATICS SKILLS, KNOWLEDGE AND CONFIDENCE DUE TO CENTRE CLOSURES

With two exceptions, teachers expected a significant impact on student learning, that would be felt especially if they were intending to go on to use A Level mathematics skills and knowledge in their university course. Sometimes (in 6 of 26 such responses) they referred to students not having completed the specifications, so not ever having met some ideas, but largely they talked about impact on consolidation, on synthesising ideas, on depth and confidence of grasp. Such responses varied from a cautious account of impact, to a considerable impact expected:

'We had finished the course by lockdown starting so they have covered all content but had not fully consolidated it yet. This will mean they find their first year courses at university a little harder than in a normal year but I think they are in a good enough place to be able to get to the same outcome by the end of their first year of university to make it up' (T1 C1, EoYS);

'I'm sure there will be a negative impact. Some students would have been very conscientious and completed the course and practise papers in the event of them having to resit the exam at the earliest convenience. Other students would not have engaged, would have been happy not have had to sit the exam and probably felt as though they have had an "easy win"' (T2 C3, EoYS);

'In terms of content, there is not much difference between this year and a normal year, as I had just about finished the course with my students. However, the 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. If they don't keep practicing doing maths at home, which is likely, they are going to find the start of university very challenging if they go on to do a mathematical course' (T1 C4, EoYS);

'The lack of focused revision and practice is going to leave some significant gaps in pupils knowledge especially for those now moving on to study mathematical courses at University. The revision period often serves to help pupils make significant links between the topic strands and pupils learning in the final stages of the course is always accelerated' (T1 C2, EoYS);

'In previous years this was the time of the big push where grades really improved for some as work was consolidated and understanding clicked in. Most of this years cohort have simply not done this (for some this is teenage lethargy, for others this is due to genuine circumstances which make home working very difficult). This cohort will largely go onto uni with maths skills noticeably lower than those of previous years' (T1 C10, EoYS);

'Maths: These students are not as practiced/secure in all the skills. They haven't done the level of revision that a normal year would (I can't blame them for that - you can't get exam ready without an exam to aim for). FM: I think the Further Maths students going onto Maths or related degrees did keep practising and are as strong/confident in their skills as in previous years - in fact several of the strongest have pushed onto more challenging work to be uni ready. In general students will be rusty when they go to Uni as they have been out of an educational environment for a long time and in many cases do not have the experience of remote learning that the year 12 do (who have done over a term of it)' (T2 C13, EoYS).

Just occasionally, teachers also referred to a possible positive impact of the lockdown on student mathematical progression:

'For the two students I had sitting STEP it meant they were able to focus on these exams and potentially that the gap was reduced between them and those in private schools who have the capacity to do taught lessons for STEP (we don't have the capacity)' (T1 C1, EoYS);

'Lack of motivation to learning due to cancellation of exams will negatively effect lots. Though I know at least one has "found his love of learning again" and is putting lots of time into preparing for next year. He feels able to do this because of the lack of pressure' (T2 C10, EoYS);

'For some, the impact will be minimal - they are organized, independent, and some even thrive on being able to work at their own pace, using videos that they can pause, re-watch etc. But others relied heavily on the classroom and college environment to maintain their focus and motivation, and many found that not being in a classroom surrounded by other students has made it a lot harder to stick to the routines that they relied on before. In some cases, having been freed up from teaching 'to an exam' means we have been able to guide students to focus on the particular bits of the course (and beyond) that they will find most useful in the future - it has been helpful to raise their sights beyond an A-level assessment and say "why did your course want this grade? what maths will you be relying on in the future?" Some have taken away some additional mechanics resources to prepare them for an Engineering degree, and some are working on some coding resources I've made to help them with Computer Science, etc.' (T2 C12, EoYS)

'My students were mostly applying for engineering course, so I did try to stress the importance of moments, forces and differential equations on an engineering course (I studied engineering myself!) but many of them still didn't see the point. I did encourage them to ensure they at least download our videos and powerpoints while they still have access to the VLE so that they have something to refer to at university if they need to' (T3 C12, EoYS).

Given the circumstances under which some students completed the survey, which for some was after the announcement of the cancellation of A Level examinations, there were also a few who had suddenly lost confidence in their expected outcome, although for some the closure of centres had been positive:

'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' (S102, Spring S);

'Who even knows now with Covid. Maths, definitely. Further Maths - I'm less certain - The content relatively easy, but the exams are infamous for being difficult, and without sufficient resources, I feel unprepared' (S208, Spring S);

'Yes, I feel that if I took the exam as it was scheduled, I would've been able to achieve my personal target & predicted grade (A), as after the Easter mocks, I ramped up the amount of hours I spending on maths, per week, as well as I started doing more practice questions in topics I struggled with. Even doing practice papers now, I feel like I am still improving. But now I'm not sure: I hope my teachers will take note of my improved performance' (S79, Spring S);

'No. Corona virus prevented me taking the final exam, which would have given me the opportunity to actually try for the A' (S76, Spring S).*

3.2 APPROACHES TO WORK AND RESOURCES FOR YEAR 12 STUDENTS

In contrast, most teachers had attempted to maintain teaching of year 12, though synchronous provision throughout was unusual. They had monitored submitted work in ways they generally felt had been effective, but student response had been variable, and most teachers expected to find significant, and a wide range of, learning gaps come September.

Resources focused on usual textbooks and exam papers, plus additional websites that sometimes included monitoring and assessment features. Students were usually already familiar with these.

Many teachers experienced some 'live' contact as the term progressed, and most expected to have seen some, though not all, students face to face at least once before the summer break.



3.2.1 WORK EXPECTED OF YEAR 12 MATHEMATICS AND/OR FURTHER MATHEMATICS STUDENTS POST-CLOSURE

In general, and in contrast to much of the year 13 provision reported above, teacher survey responses indicated that year 12 students had been expected to engage with mathematics up to the same extent as they would normally, though by different means, and frequently without synchronous teaching, at least for the earlier part of school closures:

'We have invested significant amount of time and effort into year 12. They have been provided with approximately 4-5 hours' worth of maths work and activities to complete each week' (T1 C2, EoYS);

'We continued with the content and students had to submit all their work via google classroom. We continued having end of topic assessments under exam conditions (as much as possible) and we even had our end of year exams remotely. We did carry out a few live revision sessions for the students that were not compulsory but were well attended' (T1 C3, EoYS);

'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' (T2 C7, EoYS);

'To continue with the syllabus in the form of lesson videos created by teachers and homework questions on Google Classroom and Google Drive' (T3 C9, EoYS);

'Continued to ask for 9 hours of work per week. 4.5 hours of lessons and 4.5 homework' (T1 C13, EoYS);

'They are set 4 assignments each week. Each piece of work has 1-2 pre recorded videos lasting from 10-20 minutes followed by around 1 hour of work. This is all set through the Google Classroom. More recently this has been changed to 3 assignments plus 1 55 minute live lesson through Google Meet' (T1 C1, EoYS).

One teacher even thought students had made more progress with ‘coverage’ than usual, though ‘coverage’ is not the same as learning, and 6.2.4 addresses the issue of monitoring and evaluation of year 12 learning over this period:

‘Online teaching of A Level content continued. We managed to deliver more content than we would have in a normal year because we did not put as much emphasis on final exams’ (T1 C11, EoYS).

Further, at least one centre reported being able to provide an enriched curriculum over this period:

‘Quite a bit - the fast track year 12 group still had a significant amount of content left to cover in order to be on track for starting Further Maths in the autumn. As a result, I’ve been setting about 3 to 4 hours’ worth of new content work, accompanied by video tutorials and additional resources, holding live sessions for the last few weeks, for 90 minutes each, twice a week, and having students submit work weekly for review. They have also completed an assessment not dissimilar to what would have had them sit in college. I’ve also been publishing enrichment resources for them on computer coding and run a competition designed to be similar in format to the Ritangle competition, which a number of them have engaged with well’ (T2 C12, EoYS).

3.2.2 CURRICULUM AND/OR ASSESSMENT RESOURCES DRAWN ON FOR EXPECTED YEAR 12 WORK

Ten of the 28 teachers used just the Pearson textbook and AS practice and past papers; others included those but were more wide-ranging, although that usually reflected their normal approaches:

‘Pre recorded videos made by me using an IPEVO 4K Visualiser, Textbooks accessed through ActiveLearn, Integral Maths topic tests and exercises, MadasMaths practice papers and topic booklets, Questions from the old FP2 textbooks’ (T1 C1, EoYS);

‘The Pearson textbook, PPTs from Dr. Frost & Owen on TES, video’d PPTs from Habs via Youtube and assessments from Integral’ (T2 C3, EoYS);

‘Same as if we had not gone into lockdown. Lesson pdf’s, textbook, examsolutions.net, madasmaths, physicsandmathstutor’ (T2 C11, EoYS);

‘We chose to use Turnitin on Learnzone and used exam questions from different sources e.g. Naiker Maths, Crash Maths, Pearson for assessment submission. The remainder of the content was guided by Dr Frost PPTs and adding a voice-over to these, along with supporting material already on the Learnzone page’ (T1 C12, EoYS);

‘Pearson textbooks, question sets that we put together for them weekly, Physics and Maths tutor website (for old spec questions by topic, and for the Solution Bank). Haberdasher’s Adams School maths dept YouTube channel (links to Pearson textbooks), CrashMaths practice papers’ (T3 C12, EoYS).

3.2.3 SYNCHRONOUS CONTACT WITH YEAR 12 STUDENTS SINCE CENTRE CLOSURES

12 of 28 teachers responding said they had had no live teaching and learning contact with students since schools and colleges had closed, although one had made some teacher 'phone calls home:

'None - not allowed to use Zoom, Whatsapp etc. Available through email or google classroom but very few (2 out of 23) have contacted me with questions' (T1 C10, EoYS);

'None. Some short pre-recorded videos by a member of staff, but not much more than this' (T2 C7, EoYS);

'Currently none. Next week (and the following week) they will be able to come into school for a 2 hour review lesson' (T1 C7, EoYS).

Six teachers reported having had some synchronous teaching of year 12 throughout, and the remaining ten had moved to some synchronous teaching partway through, usually as their centre leadership became more confident about the safeguarding implications of such contacts. By the time of the survey in July, two teachers from one centre were reporting the normal scale of contact:

'Normal 1 hour lessons 5 days per week. Live lessons on Teams with pupils uploading work to showbie daily for individual feedback and monitoring' (T1 C11, EoYS).

Others reported a variety of approaches between none and full scale of contact:

'All classes have had at least one 'live' lesson a week via a google meet, which is now the college minimum. They have also had 1-1 support if needed and for a few who had struggled we had a support day in college for face to face support' (T2 C13, EoYS);

'Two weekly 'problem classes', channel and chat functions in MS Teams, regular 1:1 or small group video calls in Teams' (T3 C12, EoYS);

'Two live meet ups a week (although not all students attend), of 90+ minutes each. In addition, the occasional one to one call with a student (either for additional support with STEP or to talk through how lockdown is going or offer tips for maintaining focus or avoiding procrastination). One to one often works better in terms of me finding out how they're doing with their maths - even in a group of 6 or 7 they are less likely to talk freely and become more like an audience than a mutual study group' (T2 C12, EoYS);

'We had one live Q&A session where they could ask questions on revision work prior to mock exams in early June (T2 C3, EoYS);

'Year 12 pupils have had 2 live lessons per week through remote teaching software. Pupils have also been invited into a 1 day workshop in school' (T1 C2, EoYS);

'Recently we have been doing weekly 55-minute live lessons through Google Meet. Previously we used the comments feature of Google Classroom to have dialogue with students. School expectation is that we respond to student comments within 1 hour if posted during our scheduled 'lesson time' but I try to respond as quickly as possible on any working hours' (T1 C1, EoYS).

3.2.4 MONITORING AND ASSESSMENT OF YEAR 12 STUDENTS' WORK

Almost all teachers reported monitoring year 12 students' work in ways they felt were effective – although student submission had been variable:

'I mark every assignment using Google Classroom rubrics and private comments. Quality of work submitted has been very high and I actually believe some students have thrived with this enhanced marking during lock down. However, I am still only getting around 2/3 of students submitting work despite regular contact with parents' (T1 C1, EoYS);

'We have been setting regular assignments, including assessments using microsoft teams. This coupled with live teaching has ensure high levels of progress for all year 12 pupils. approximately 96% of the year 12 cohort has been engaging with large amounts of our provision' (T1 C2, EoYS);

'All work has been marked and given back to students with feedback. Student engagement has been very good - about 90%' (T1 C3, EoYS);

'I still set homework tasks regularly, in addition to all the classwork. On the whole, my classes have been very responsive, especially compared to the Year 13 classes' (T1 C4, EoYS);

'Can monitor participation on MyMaths. Asked students to submit their marks to the Pearson end of chapter tests (very high scoring suggesting they have all marked generously so not the most informative measure). Approximately 85% of students are engaging with the work' (T1 C7, EoYS);

'One to one question and answer, completion of small tasks during lessons and marking homework and set assessments. BUT the response has not been much less satisfactory than normal lessons. Again due to the lack on control and inraction' (T2 C8, EoYS);

'Showbie has been used to upload work completed with model solutions/feedback given to students. 90% of students have engaged with new learning structure' (T1 C11, EoYS);

'Approximately 80% of the students submit the work each work for my year 12 class. This is monitored on Learnzone where engagement with the PPTs and the submissions can be viewed. Regular communication via email helps to maintain dialogue about work expectations with the students' (T1 C12, EoYS).

Two teachers, though, were specific about evidence of poor engagement:

'I set up questions in GC which pupils simply needed to respond to confirming they had completed an exercise or homework. A good response is 25% of class saying it has been done. In reality I think it is about 15% of students who have done all that was asked of them!!!' (T1 C10, EoYS);

'They submit their work on google classroom. The majority have done what they have been asked but a significant minority have done nothing or very little since the start of lockdown' (T3 C13, EoYS).

3.2.5 YEAR 12 SUMMER TERM IN-CENTRE CONTACT

From after half term (early June) schools and colleges were permitted to re-open for priority year groups, as well as continuing provision for students at-risk and younger children of key workers. Re-opening was subject to social distancing and detailed hygiene measures. In post-primary education year 12 and year

10 were usually considered to be priority, though any re-opening if not to the whole school also brought tensions of often smaller classes needing greater than usual provision of staffing, while provision for at-risk students and those working at home also continued as before. However, it is interesting that 17 of 28 responding teachers said their year 12 students had (in July) received no in-centre contact since lockdown:

'College is still closed. No in college learning took place' (T1 C8, EoYS);

'None. Students are having live lessons in all subjects and will be invited in for a UCAS workshop before the end of the year' (T1 C1, EoYS);

In July others, with the exception of one centre, ranged from access for exams only, through small-scale targeted support to one or two sessions for all students.

'The Year 12s have not done any learning at school. As soon as they were allowed to come back, they had 2 weeks of exams' (T1 C4, EoYS);

'1 x interview and full set of end of year exams' (T1 C6, EoYS);

'College has organised for at risk students and those who have struggled working from home to be able to come into college and work - this was non-subject specific. Each subject has had one support day in college where we offered subject specific help to invited students. Some of these students needed help with the Maths but most needed help with how to work at home - so we signposted all the resources and gave them the opportunity to work with support - the aim being that if they got started the momentum could continue at home' (T2 C13, EoYS);

'A small number (30) of maths students who had done nothing since the start off lock down were invited in to college for a day to work in a bubble of 5 with a teacher' (T3 C13, EoYS);

'Around 1/2 of the year 12 students have had access to lesson time in school on one day a week for 4 hours. We invited the students of most concern, either for engagement or prior academic achievement' (T2 C9, EoYS);

'We have offered a 3 hour in -school session which allowed us to teach the pupils in small groups of 10-15 pupils. Pupils were surveyed prior to the session to identify which topic strands they felt most/least comfortable with so that teachers could focus on work in these areas. The sessions were focused on previously taught year 12 content with a slight emphasis on topics covered during lockdown' (T1 C2, EoYS);

'They will have all had two 2-hour sessions with a specialist teacher covering the material that they have been through during lockdown - one pure and one applied lesson' (T2 C7, EoYS).

Any sustained in-centre general provision was therefore unusual, with just one centre re-establishing a more extensive, though still not usual-scale, provision. Note also that re-opening did not usually bring full-scale student attendance:

'For the last 2 weeks we have restarted lessons. This was 2hrs/week and is now increasing to 3. I am going over in one lesson each of the chapters set for doing at home and then will move on with normal teaching BUT not all pupils are back so some still need work set on Google Classroom' (T1 C10, EoYS).

3.2.6 EXPECTED IMPACT ON YEAR 12 MATHEMATICS SKILLS AND KNOWLEDGE DUE TO THE PANDEMIC

There was a general uncertainty about any impact on learning, though four of 28 teachers reported feeling at least moderately confident about their students' learning going forward:

'For those who have been engaging in the online learning, I think they will potentially be in a better place than normal due to the enhanced feedback they have been getting. They are now also the only class I am teaching so are getting more of my time for planning. For those not engaging, I think they are going to struggle to catch up but, as a positive, all the pre recorded videos and lessons will still be accessible through the Google Classroom so they will have the resources to do so' (T1 C1, EoYS);

'They are in a good position because they have covered more content although the quality of the learning may be compromised. We will have more time for revision this year so it should not have a big impact' (T1 C11, EoYS);

'For our students we hope that the quality of their learning in the last few months will not have been dissimilar to other years. We have been very fortunate with the technology available to us and the resilience and innovative nature of our staff body to come up with and share ideas of best practice. Naturally there will be more variation in students conceptual understanding as we miss out on the face to face cues and the ability to inspect all work during lesson for misconceptions. However, we hope to pick that up and deal with it in September without too much hassle' (T2 C11, EoYS);

'We are going to have to do a little catch-up next year however we have managed to stay on top of new learning. Due to the high levels of engagement in the remote lessons and the high amounts of engagement with remote assignments pupils have built up good levels of knowledge throughout this period. The challenge will be assessing and identify misconceptions that may have crept in unnoticed so that these can be rectified early on' (T1 C2, EoYS).

Most teachers, though, gave more nuanced responses, with a common concern that gaps between the well-organised and diligent, or those with effective digital access, and others, would have widened:

'There will be discrepancy between students that engaged with online learning and those that did not' (T2 C1, EoYS);

'It is likely to have a large impact on any students who were not willing or able to complete enough work in order to fully understand the new topics taught. This will negatively affect next year's work because they will need to build on the topics learnt over the lockdown period' (T1 C4, EoYS);

'Significant impact as students struggled to learn new topics without face-to-face contact' (T2 C6, EoYS);

'Our students generally said that it was very frustrating as they could not always take part in solutions. Majority complained that IT were the biggest issue (wifi was the biggest problem, slow response, older technology), a lot of students had issues at home and could not concentrate on the lesson, many missed the work with their friends and using time to discuss 'how to' before they started to solve the questions. Unfortunately a few students did not have computer/ laptop available as they had siblings using it at the same time and this limited their participation. Everyone expects that every child/young person have their own laptop but many our students don't' (T1 C8, EoYS);

'Students seem to have lost the desire to 'ask questions' and really explore the maths they are learning. Even whilst teaching physically, I noticed that students are much more used to being fed information as opposed to digging deeper' (T2 C9, EoYS);

'We are behind - I would normally be into yr2 content by now. The most highly motivated and able will experience little impact from this period. The majority, who need pushed or supported will suffer. Not only have many NOT even attempted the work set, some have gone backwards forgetting some of what they already new. The regular 16/17yr old maths student does not often show, at this point, a great work ethic. As we are now behind we will not have much revision time (already less than with old A-level) and that period where some of the behind students transform themselves will not be there for them. I fear that there will be a substantial impact on the "average" student' (T1 C10, EoYS);

'Students will head into year 13 with a much more varied range of knowledge (between engaged and non-engaged). They will have a more superficial understanding of topics and find it more challenging to build year 13 content onto their existing year 12 content' (T1 C12, EoYS);

'Some are doing better - finding the pace easier to manage now they're not commuting and can listen to a tricky explanation at their own speed, and re-watch as needed. Others relied more heavily on the community of the classroom to maintain their motivation and focus, like the year 13s, and these are most often 'the spirit is willing but the flesh is weak' students who want to want to work, but are struggling either to find the motivation, or to maintain confidence when working completely alone on difficult problems, or are simply dealing with difficult things at home including (and this is just the ones I know about) family illness and bereavement, housing issues, stress and anxiety and - last but not least - internet connectivity!' (T2 C12, EoYS);

'Significant. They have 'done' the work but done to complete and tick off a to do list - not done, revised, revisited and understood. Significant. They have 'done' the work but done to complete and tick off a to do list - not done, revised, revisited and understood' (T2 C13, EoYS);

'The gap between the good students who have engaged and done all the work and the ones who are not doing well will be much bigger than usual. The good students have not really suffered - they have reported that they have felt fine learning at home and some have even preferred it! However the students who have not been able to motivate themselves to work at home are now a big problem for us. We don't really know yet what to do about them' (T3 C13, EoYS);

'We would usually aim to cover 2 chapters from Pure Year 2 during the summer term of year 12. We have been unable to do this and will have to review the topics which pupils have self-taught when back in school. This will place us under greater time pressure to cover the year 13 course. Year 12 have also not sat (or revised for) an end of year exam so I expect their recall of the AS content will be weaker, as they won't have pulled it all together' (T1 C7, EoYS).

3.3 APPROACHES TO WORK AND RESOURCES FOR YEAR 11, BY 11-18 CENTRES

18 teachers worked in 11-18 centres. Just three reported expecting post-closure work from all year 11 students. Another ten had provided for those intending to take mathematics A Level(s); scale, scope and monitoring within that varied significantly. Student participation in, and commitment to such transition provision, had been varied. There had been little formal assessment of related learning.

A wide range of resources had been used for such purposes, including Edexcel A Level materials, CGP and free online transition resources, and centre-developed materials.

Most teachers expected significant gaps in depth and fluency of GCSE work, and planned additional formative assessment for the incoming year 12, usually within a 'business-as-usual' framework.



3.3.1 WORK EXPECTED OF YEAR 11 POST-CENTRE CLOSURE

Ten of the 28 teachers work in post-16 centres. Of the remaining 18, just three teachers from one centre reported mathematics provision for all of year 11:

'Revision - 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' (T1 C9, EoYS);

'We finished the content with students and encouraged continuous revision. We made a particular focus on students who we believe are at risk of not attaining a grade 4' (T2 C9, EoYS);

'To finish the syllabus in the form of lesson slides, resources and small homework tasks otherwise nothing else at all' (T3 C9, EoYS).

Of course, teachers in 11-18 centres were also providing for at least students in years 7-10, and year 12, as well as for students at risk or with parents working in key worker roles who were still attending school. Some teachers reported no, or minimal, contact with year 11:

'None. The school decided to that we wouldn't ask year 11 to engage in work in any subject' (T2 C3, EoYS);

'Not much, the response from any over google classroom was tiny, and soon stopped altogether. So no work has been set yet' (T2 C10, EoYS).

However, another ten of the 18 teachers in centres with year 11 students reported some provision for those intending to continue to mathematics A Levels, though this varied in scale, duration, structure and support:

'We asked students to sign up for the A Level courses they were planning to study and then we set up transition classrooms for these courses. I've really enjoyed this and I think Year 11s will be in a better place for starting A Level in September as we have been able to focus on the key algebraic, geometric

and numerical skills needed for A Level in contrast to prepping for GCSE which, since changing to the new spec, is more focused on multiplicative reasoning’ (T1 C1, EoYS);

‘After exams cancellation were announced we launched the year 11 school. This operated purely online and pupils who had identified an interest in taking A Level maths were invited to the maths school. A group was created on Microsoft Teams which set weekly tasks and assignments looking at GCSE crossover content and ensuring pupils were confident with this’ (T1 C2, EoYS);

‘Bridging unit for those students considering studying A Level Maths’ (T1 C6, EoYS);

‘If needed, we finished the rest of the GCSE course remotely. Then they were set "Summer term tasks", which involved a lot of preparation for next year and reading around the subject, but we don’t know how much they engaged with that’ (T1 C4, EoYS);

‘Nothing regarding GCSE, but those returning to do A level next year have had a seven week transition programme based on honing their algebra skills. They can submit work if they want to’ (T2 C7, EoYS);

‘They are about to join the online groups of their chosen subjects next year, for two weeks. We will be asking them to self assess using a CGP book, complete transition materials supplied by AMSP³ and also attempt a data/modelling project based on covid-19 data (which I have created during lockdown)’ (T2 C10, EoYS).

The above responses are consistent with previous years’ findings that teachers consider there still to be a gap between GCSE Mathematics and a confident start to mathematics A Levels: one which is centred around a deep algebraic fluency, so that students need to know GCSE ideas in a rather more holistic and flexible way. Note that although teachers often point to the need for students to bring greater capacity in reasoning and problem solving, that is not specifically mentioned above, although some earlier responses suggest teachers think those are much harder to develop in distance learning than when teaching is face to face.

3.3.2 CURRICULUM AND/OR ASSESSMENT RESOURCES DRAWN ON FOR EXPECTED YEAR 11 WORK

Fourteen teachers responded, with two of them mentioning past papers and three others including other Edexcel resources:

‘Work covering first two chapters of AS Level textbook’ (T1 C6, EoYS);

³ The AMSP work referred to above is freely-available transition work targeting a confident and connected grasp of GCSE content for year 11s intending to continue with mathematics A Level(s), available via <https://amsp.org.uk/news/s-1-jul20>: ‘As part of the AMSP’s [support to schools and colleges during lockdown](#), we have provided a set of Year 11 to Year 12 transition materials which are now freely available on our [website](#). They are designed for students to use on their own, as full solutions are given, and there are around three hours of work in each unit. There are also teacher notes for the transition resources on our [website](#).’ These resources have been widely advertised, but compete with many others available, of variable quality, and teachers from only one of our centres mentioned them.)

'In house resource based on questions from exam wizard. Internet research on a topic of their choice - report written and marked' (T2 C4, EoYS);

'AMSP Transition Resources; Transition resources from an Edexcel Remote CPD session run by Pietro Tozzi; Teacher.desmos and Student.desmos; Geogebra; Underground Maths' (T1 C1, EoYS).

Three teachers mentioned 'Hegarty Maths' and four, either free or paid-for 'Head Start to A Level Maths' booklets:

'The CGP books have sections where they must "self diagnose" skills. We will back this up with videos on Hegarty maths' (T2 C10, EoYS);

'Free 'Head Start to A level' online book and MyMaths' (T1 C7, EoYS).

Finally, several teachers pointed to in-house development of provision:

'Nothing other than teacher created lesson slides and Hegartymath's (T3 C9, EoYS);

'None, resources were produced in house' (T1 C5, EoYS);

'In house resource based on questions from exam wizard. Internet research on a topic of their choice - report written and marked' (T2 C4, EoYS).

External, non-Edexcel specific sources of transition to A Level support, apart from the AMSP resources mentioned in the quotes above, included:

<http://www.queens.herts.sch.uk/wp-content/uploads/2019/02/Maths.pdf>;

<https://unquotebooks.com/download/head-start-to-a-level-maths/>;

<https://www.cgpbooks.co.uk/secondary-books/as-and-a-level/maths/mbr71-head-start-to-a-level-maths>.

3.3.3 EVIDENCE OF THE EFFECTIVENESS OF YEAR 11 LEARNING DURING CENTRE CLOSURES

Three teachers quoted online marks from Hegarty Maths as evidence of student learning over lockdown; two others, from one centre, said they had marked some work for potential A Level students on Google Classroom:

'Submissions marked by teacher on the Google Classroom' (T1 C1, EoYS).

All other teachers in 11-18 schools reported no assessment of year 11 work over this period:

'Attendance and engagement with year 11 school (for potential A Level students only) has been around 70%, however all work has been self marked and we have not been assessing pupil progress with this group' (T1 C2, EoYS);

'No work was taken in or marked during this time' (T1 C3, EoYS);

'We did not collect data on this' (T2 C7, EoYS);

'Not very effective at all' (T2 C9, EoYS);

'I am not confident that many did any learning over the closure period. I have not seen any from my year 11 class' (T2 C10, EoYS);

'None, no results recorded, the only indication is the support requested (by students planning to take A Level)'(T1 C5, EoYS).

3.3.4 PLANS FOR FORMATIVE ASSESSMENT OF INCOMING YEAR 12 STUDENTS' LEARNING GAPS

Two of 28 teachers were not sure (in July) about the approach that was going to be adopted in relation to formative assessment of year 12 knowledge and skills:

'Our timetabling is on hold, so we don't know yet what time (if any) we will be allocated to help with this. If no extra time is allocated and our timetables are all full all we can do is offer extra revision classes in the holidays (our teaching day is already until 4:30 so it's not practical to offer this after school)' (T3 C12, EoYS);

'I don't know! We don't really have much of a plan for dealing with this at the moment' (T3 C13, EoYS).

A further six of 28 teachers said that arrangements for such formative assessment were changed this year as a result of students' different experiences through year 11, though some still harboured doubts about how effective this would be in addressing gaps in learning:

'Our new homework style incorporates a revisit section (revisits a previous topic some time after it was covered) which help with this. Due to the nature of Maths (how it builds on previous knowledge a lot, very little is stand alone) a lot of the gaps will be uncovered and improved in lessons as we build on the skill. It is going to be a challenging time to support students who have not completed work during lock-down and more development will be needed in September' (T2 C13, EoYS);

'Adjustments to the scheme of work will be made to allow more time for the first 5-6 chapters of the pure content to help students "catch up" to the required level to begin A Levels. Additional support may be needed but the details of this have yet to be discussed and finalised' (T1 C12, EoYS);

'Assessment initially and then support sessions for particular topics covered during lockdown' (T2 C9, EoYS);

'Although having time restriction, we would plan extra teaching , set homework and assessments to cover the essential year 11 topics they might have missed out and to prepare them for year 12' (T2 C8, EoYS);

'We are going to go much more slowly through the introductory chapters and provide early intervention when required' (T2 C7, EoYS);

'Spending more time on Chapters 1-4 of Pearson Pure textbook - for the past couple of years we have only spent 12 lessons on this but we expect new year 12s to have weaker algebra skills' (T1 C7, EoYS);

'Run extra sessions after school for students struggling to make the transition' (T1 C6, EoYS).

The remaining 20 teachers reported 'business as usual', although it is clear that many centres go to some lengths to support 'bridging' between GCSE and A Level, expecting to find a significant gap for many students. About half those teachers talked about successful progress, with such bridging comprising a hurdle before participation in A Level was agreed:

'We provide our own year 11 who have chosen A-level Maths with the CGP transition booklet which I link to Hegarty Maths and other worksheets. We will be testing them early in year 12 on the skills covered in the booklet. I aim to them provide intervention for those with identified areas of weakness (but this depends on what the school will support); if they really can't get on top of that in a reasonable time then they will not be continuing with A Level' (T1 C10, EoYS);

'We always go over the algebra and trigonometry basics and do an early assessment to see if the students are at the level they could cope. We have a lot of practice resources online to catch up if students are not confident with algebra/ trigonometry and they still want to continue with A level maths' (T1 C8, EoYS);

'We intend to continue with periodical assessment in the new year as in the past and place a suitable intervention programme whenever possible' (T2 C6, EoYS);

'Regular assessments and intervention where needed. We are also asking students to complete an induction task (first 2 chapters of the course) and they will be required to pass an entrance test (Algebra based) before being accepted onto the course' (T1 C3, EoYS);

'Over the Summer holidays, Year 11 will be set a long list of questions, which they need to complete for the first lesson back. This will mainly be algebra questions, as A-Level is very algebraic. This will be marked by the teachers and will be used to inform how much the students already know. (This is how the school has always done Sixth Form transition and I don't expect it to be different this year') (T1 C4, EoYS);

'We will do the same as normal: An induction test (focused on algebraic manipulation, surds and indices) which we use to identify students needing additional intervention' (T1 C1, EoYS);

'We have already introduced prior knowledge assessments for many units of work. These can be used to identify which topics pupils do and do not know before teaching commences. This will allow teachers to better plan their sequence of lessons to accommodate closing unexpected gaps, though we expect there to be more of those this year' (T1 C2, EoYS).

3.4 THE EXPERIENCE OF CENTRE ASSESSMENT OF STUDENTS' A LEVEL (AND AEA) GRADES

27 mathematics study teachers had inputted to student CAGs, sometimes responding to a centrally-produced initial list. The cross-curricular research included 13 Heads of Mathematics and 44 teachers of A Level mathematics, who generally felt satisfied with their level of involvement, well informed (though not always at an ideal time) and reasonably supported.

Centres had drawn on a wide, and sometimes exhaustive, range of existing data, sometimes supplemented by 'professional judgment' and observed approaches to work. Nine of twelve mathematics study centres had somewhat moderated draft CAGs to better align with historical performance, though a few teachers in both studies also reported centre pressures to inflate grades.

Mathematics teachers across studies found ranking more difficult than grading, although D/E grades were difficult to distinguish. They were almost all at least moderately confident about the outcomes of both processes for mathematics A Levels, feeling they were the fairest achievable, but generally felt late-developing, or late-working, students, among others, might be disadvantaged. There was little confidence in CAGs produced for AEA.

Compared with teachers of other subjects, mathematics teachers drew on more data, more thoroughly, and CAGs moderation was perhaps easier. They pointed to the emotional demand of producing high-stakes grades, and had concerns about inconsistency within departments and schools, as well as across centres.

Teachers reported some related centre-student and -parent interactions, but no significant issues. Students in the cross-curricular research said they felt reasonably informed about CAG production by their centres, though many had also made independent enquiries. Perceptions of fairness of the process varied, with many frustrated at the lack of opportunity to demonstrate what they could do.



This section differs from the others in that it draws on teacher and student responses from both the Pearson-UCL mathematics study (March-April year 13 student survey and July year 13 teacher survey), and the Efficacy and Research team cross-curricular summer series research (May/June HoD telephone interview recordings, and May/June year 13 student and GCSE/A Level teacher surveys). A methodological overview of both is given in chapter 2, but there was some overlap of questions and some complementarity. Importantly, the cross-curricular research enables comparison of mathematics responses with those in other subject areas, though we know a fairly limited amount about the centres from which responses came. It should also be noted that some teachers participating in that survey teach GCSE, but not A Level, mathematics, and that others will have been responding about CAGs and ranking at both GCSE and A Level. We have included some comments about GCSE, and some without clear reference to level, in part because issues with GCSE CAGs might affect students progressing to A Levels.

Responses from both sources have implications for a variety of players, and those are discussed in section 4.

3.4.1 TEACHER ROLES IN DEVELOPING STUDENT CAGS

27 of the 28 mathematics study responding teachers were involved in producing centre-assessed grades (the other was on maternity leave). Many of these had produced grades and ranking for at least the maths classes they were involved in teaching, often negotiating those with another teacher with whom they share a class:

'Myself and the "applied" teacher together decided the grading and ranking of our year 13 cohort' (T1 C10, EoYS);

'Agreeing the grades and ranking of my class with the other teacher' (T1 C7, EoYS);

'I made the final decision but worked closely with the teacher of Pure to come to an agreed decision' (T1 C10, EoYS)

Sometimes, as mentioned five times, such work was moderation in response to grades and rankings produced elsewhere on the basis of performance data held centrally:

'Students were ranked via their internal test scores and then I was asked if I wanted to change the rankings of the students within my classes. I was not told if my suggestions were accepted' (T1 C4, EoYS).

At least 15 of these 27 teachers had overall responsibility for at least all mathematics A Level grades, where necessary moderating across, as well as within, classes. This level of involvement in part reflects the profile of our participants, who are often highly experienced and/or senior teachers. It is clear centres had different approaches to the task, although sometimes that reflects the size of the centre and number of mathematics A Level students: the task was clearly more complex where there were several such classes involved:

'As a class teacher for one year 13 group, providing my personal professional holistic judgement of the grades and ranking for my class. As a member of a 3-person maths team, collating the rankings and adjusting notional grade boundaries across the groups to mitigate any unconscious bias and provide a realistic grade profile. As a member of our sixth form, writing a spreadsheet tool to combine Formal Assessment grades to give teachers and managers a starting point for grade comparison and ranking within a subject area' (T2 C12, EoYS);

'I'm Curriculum Manager for A-Level Further Maths so took the lead on that. I was also involved at a teacher level on A-Level Maths and GCSE Maths' (T2 C13, EoYS);

'As KS5 co-ordinator I was heavily involved in this process. I used statistical analysis to come up with an initial prediction for students based on their data - I then co-ordinated conversations with teachers to fine tune this based on each individual's circumstances' (T2 C9, EoYS);

'Checking that A Level ranking/grading was correct after initial ranking by SLT and adjusting accordingly after my input' (T1 C11, EoYS);

'I am A level maths coordinator so I collated the spreadsheet with all the results (assessments from November and Mock exam in February including chapter tests) and we discussed with the rest of the teams possible grades. The ranking was harder (especially ranking students across the groups) but we looked at these separately. We also looked at our previous results and checked if the results are approximately matching our history of results. We had a few more A grades but we had a cohort of Y14 students (improving grades) who worked extremely well and their results were showing this fact. These suggestions were passed to the management team' (T1 C8, EoYS);

'I used mock exams and topic tests plus historic results to map out a proposed grade for Year 13 students and a proposed ranking. I then met with all of their teachers to moderate and check these grades and rankings. For AS students, we only had one student who was entered for the exam' (T1 C1, EoYS).

The cross-curricular research drew on survey responses from 68 teachers of Mathematics GCSE, and an overlapping 44 teachers of Mathematics A Level; unfortunately, it is often not possible to distinguish which level of CAGs/ranking teachers re talking about. They had experienced varied involvement in producing CAGs and rankings, but 84% of the 95 mathematics teachers responding in the cross-curricular research were broadly happy with the involvement they had.

In terms of their preparedness for producing CAGs and rankings, 70% of mathematics teachers responding to the cross-curricular survey agreed or strongly agreed that they felt well informed, and 4% disagreed or strongly disagreed: they were more satisfied than was the general case, though a differential confidence in handling data might well contribute to that. Mathematics teachers, on the whole, also felt well supported throughout the process: 64% agreed or strongly agreed with this statement, while 9% disagreed or strongly disagreed.

In relation to sources of relevant information, mathematics teachers cited email updates and documents from Pearson and other awarding organisations, government guidelines, Ofqual, JCQ, online news articles, Twitter, Maths Hubs, their SLT, heads of department, and exams officers who filtered relevant information for them. It was noted that information came out at different times, which was not helpful. Some mathematics teachers also commented that they would have liked more information about what other schools were doing, as they sometimes felt quite isolated.

Their use of, and views on, the support provided by Pearson varied, with some not accessing that at all, while others felt as if they were being overwhelmed with information. Most, though, found it at least moderately helpful, with 46% of cross-curricular survey mathematics respondents rating it 'very good' or 'excellent', while 11% rated it 'poor' or 'very poor'. Some identified the regular updates from Pearson as particularly useful:

'Regular updates with links to more detail were very useful-including the one today with information about how the process will progress once all centres grades and rankings are received' (S178, GR TS).

Some, though, would have liked more information about GCSE tiering issues:

'Information based on ranking all tiers together could have been shared earlier' (S279, GR TS).

3.4.2 EVIDENCE DRAWN ON TO PRODUCE CAGS

20 of the 27 teachers involved in the mathematics study reported making use of internal tests completed during the course, together with end of year and 'mock' results, and often (in 14 cases) only those:

'Internal assessment data from across year 13 including topic assessments, year 12 exams and December mock grades' (T1 C2, EoYS);

'All internal assessments – we have one every two weeks' (T1 C6, EoYS);

'We used our assessment result data (a test every half term) as the backbone of the process. A big advantage for A-Level Further Maths was that we had the student's AS results which are well correlated with their A-Level result. We tested our methods on last year's data including correlating all our assessment data to the final results to see which had the strongest correlation and therefore help us use this year's data to give the most accurate results' (T2 C13, EoYS).

Others reported a wider (sometimes very wide), including often comparative with other cohorts, and sometimes more subjective, range of information drawn on:

'Mock exam results, topic assessment results, teacher experience from class, GCSE grade and set, historic results, historic improvements from mock to exam. Tools like ALPS and Sisra to check progress scores' (T1 C1, EoYS);

'End of year 12 exams, mock data, continuous assessment in the form of end of topic tests and historical data from previous cohorts' (T2 C3, EoYS);

'HoS drew up rank based on tests. Adjusted by class teacher using class contribution and homework assignment data' (T2 C4, EoYS);

'We looked at the attainment and improvement in grades of our previous year 13 cohort from the March mock to the final result. We found that most students improved by 0.9 of a grade, so applied this model to our current cohort's mock results' (T2 C9, EoYS);

'Past performance, knowledge on students' work ethic, comparison with similar student last year' (T1 C11, EoYS);

'Initially ranked the students using GCSE Maths, GCSE average, End of Y12 and Y13 mock. This initial ranking then went through three further iterations involving teacher judgment and various lower bounds e.g. no one predicted lower than mock grade' (T2 C11, EoYS);

'Formal assessments, work completed in class, "teacher instinct"' (T1 C12, EoYS);

'A blend of: Hard data - recorded internal assessment grades from both year 12 and year 13, weighted according to our opinion of how directly related the individual assessments were to the final exam (e.g. later and longer year 13 assessments counted for a lot more than early year 12 assessments) and Soft data: our own teacher instincts, combined with knowledge of the way students have been working this year and last (where groups changed teachers, discussion about each individual with last year's teacher), how they cope with assessments but also how confident we feel about any given prediction. Each teacher in our department wrote a 'gut feeling' grade initially, and then having taken

into account formal assessment grades, homework, engagement in lessons to re-evaluate and produce a finalised 'holistic judgement'" (T2 C12, EoYS);

Note that class contribution, work ethic, etc., do not usually feed directly into final grade, but rather, only indirectly via the impact they might have on learning. Such a range of approaches clearly begs questions of what A Levels ought to be measuring and valuing: should, for example, contribution to the group's work, or sustained application, be valued in tandem with performance, because of long-term benefits to the student and others? Is using 'teacher instinct' a question of capitalising on experience, or legitimising subjective bias?

In the May 2020 Efficacy cross-curricular research 13 Head of Department (HoD) interviews, it is worth noting that some aspects of the productions of CAGs were distinctive to Heads of Mathematics, as opposed to those leading other departments:

- **More data:** Mathematics departments often had much more data available than other departments, such as from regular assessments. (At GCSE, this was partly because core subjects have more time in curriculum, teach all the students, and so do more tests than other subjects). A preference among some mathematics HoDs for tracking and using data was also a factor.
- **Thorough processes:** Where centres delegated responsibility for production, mathematics departments tended to have more thorough and rigorous processes for the CAGs than other departments, e.g. use of statistical methods, algorithms, spreadsheets.
- **Moderation:** Some thought moderation is easier in mathematics because it is less subjective than some other subjects. This meant that the data used to predict grades were potentially more reliable than for subjects such as English or Art and Design.
- **Tiering at GCSE:** Unrelated to A Level, Heads of Mathematics reported grading and ranking borderline students at GCSE was very challenging and exacerbated by tiering structures. For example, it was unclear how to rank a Higher grade 5 versus a Foundation grade 5, and which grade boundaries should be used. Bunching around the middle grades made problem worse, as it was difficult to differentiate between students at the same level).

On the other hand, some aspects of their responses were common across a range of HoDs as well as consistent with the mathematics study findings:

- **Historical data:** The proposed approach to deflating grades to keep results in line with historical data was a concern, especially for improving schools, although the proposals included provision to make a case for exceptions.
- **Inconsistent use of data:** In some centres teachers predicted grades, but in others SLT, EOs or MAT administrators who don't know individual students predicted the grades. Most but not all schools used mock data, but this was considered to be unreliable because some mock papers had been marked more harshly than others and the assessments were not always conducted under exam conditions. Some schools used classwork and teacher judgement also, so the types of data used varied. However, there was often no standard process that every department had to follow, with individual departments deciding how to conduct the process, leading to potential inconsistency across departments.
- **Pressure on grades:** There was both pressure to inflate grades as well as to deflate them, depending on the school approach, with implications for fairness of the grades eventually awarded. For example, some SLTs wanted to give borderline students the benefit of the doubt, while others were worried that optimistic predictions that would take the school results above those of 2019 would result in the whole cohort being moderated down.

- **Predicting the unknown:** There was a lot of uncertainty regarding predicting grades for late developers and students (typically boys) who tend to revise just before exams and perform well in the final exam.
- **Positive:** Despite the stress involved, some HoDs thought process was as fair as was achievable in the circumstances, as teachers know students best.

Additionally, the Efficacy cross-curricular research highlighted the following:

- **Objectivity and emotion:** HoDs reported anxieties around being responsible for final grades and 'letting students down'. They thought some teachers in their departments found it hard to be objective about the students they taught.
- **Inconsistency across schools:** HoDs expressed a lack of trust in reliability of other schools' data.
- **Inconsistency within depts:** HoDs reported that some teachers in their departments weren't as accurate at marking assessments as others. The level of experience of teachers and their knowledge of students were felt to be key to the accuracy of the CAGs.

3.4.3 TEACHER CONFIDENCE IN GRADING PROCESS

Almost all mathematics study responding teachers reported feeling at least moderately confident about the grades resulting from the process:

'Very confident as our internal assessment system is comprehensive. No exceptions as we have taken every circumstance of each student carefully' (T2 C6, EoYS);

'Very confident' (T2 C7, EoYS).

Two pointed to the fact that this is only the second at-scale enactment of the new mathematics A Levels, making it difficult to know how increased adjustment to the new courses would be reflected in outcomes:

'I feel confident that the grading is as good as we can make it. It's challenging only being in the second year of a new course and that any improvements we made in teaching can't be reflected' (T2 C13, EoYS).

A small number, though, were more muted, or felt the data-based approach adopted had limitations:

'It feels "best guess" although we took as much care as we could. I'm confident at the top and bottom but not so much in the middle. I don't think that I had enough robust information recorded about each pupil to be as confident as I would like. I had planned another mock but lockdown came a couple of weeks too soon' (T1 C10, EoYS);

'Did not enjoy the process at all as ultimately I don't feel we could do the same justice as an exam would've done however I do feel according to the data we had we have assigned the correct grades' (T1 C3, EoYS);

'We followed the exact Ofqual rules. However, not sure if the grading would represent their true abilities' (T2 C8, EoYS).

'We have a rigorous assessment schedule (some were missed after March lockdown) but we have plenty of evidence to draw our conclusion. All our maths staff are strict in marking, always tell students that it is good for them to know what they can expect if they don't show their working steps. I think that we had to award some lower grades to students who were very good during the year but had lack of exam experience in February mock exam - but they would have improved with practice in the summer. Some of these students are planning to do exams in autumn' (T1 C8, EoYS);

'For the most part I felt relatively confident. I found least confident awarding grades at both top and bottom ends. It was difficult to award students an A and also to distinguish reliably between a D and E' (T2 C3, EoYS).*

Teachers in the cross-curricular survey reported variable difficulty in producing grades, but 74% of responding mathematics teachers felt at least reasonably confident in those:

'I have been teaching for a long time, and my predictions have been accurate in the past, so I have confidence my judgments are usually right. We have detailed records of students' performance in assessments throughout the course, and they had just done a second set of mocks' (S17, GR TS);

'Generally easy as we have excellent assessment systems in place and know our pupils well' (S191, GR TS);

'Regular use of examination materials with past papers and grade boundaries. We regularly assess pupils' (S237, GR TS).

However, at least eight of 27 mathematics study respondents felt that where in-centre assessments had provided the backbone of the evidence drawn on, as in the vast majority of centres, students who had under-attained because of limited effort during year 13, were potentially disadvantaged: five teachers pointed to past experience of students who had 'pulled it out of the bag' at the last minute, having under-achieved through the course. However, while they were confident at least some students would fall into this category, past experience suggested it would be by no means all such students, and in advance there was no way to distinguish which:

'Quite confident - just bottom end will suffer because there are always some students who pull it off in the final exams in normal years – you just don't know which - but this year it was based heavily on past grades' (T1 C11, EoYS);

'Some students disadvantaged - our students perform well in exams. Those who work hard at the end of the course often surprise us with their results. Laziness early in the year has severely disadvantaged them. On the other hand, the process we undertook was much more thorough than it is in a usual year when we still produce 'predicted grades' (T2 C4, EoYS);

'I felt very confident in the final grades submitted. There were a small number of pupils who may have achieved higher had they taken an exam but for whom the data did not suggest they would. A lot of statistical analysis from prior years was used to ascertain the expected progress from each data point and this was used to confirm teacher assessed grades' (T1 C2, EoYS);

'I did not feel hugely confident. I feel I was fair to most, but still there is the nagging thought that someone could have easily have "switched it on" in the latter months and actually done a lot better than is evident from the things listed above. There were a number in our class who were mathematically talented, who did not put in the required work to reach their potential. We had to

assume that they would put in a bit more work in the lead up to exams, though could not predict them a grade that was too high, even though that this would have been possible if they had really put in a lot of effort' (T2 C10, EoYS).

Such sentiments were mirrored in the cross-curricular research: mathematics teachers were concerned that boys in particular, and other students who 'coast' during the year, perhaps not taking mocks seriously, often 'pull it out of the bag' in final exams. Teachers also reported not having enough data on students who had missed school due to illness, and some teachers were new to the school and did not know their classes well. Again, a key area of concern was having to ensure the grades were aligned to the school's historical data: teachers often felt under pressure from different directions, for example senior teachers asking them to inflate or deflate grades, from parents, or as a result of their own emotional attachment to their students and a heavy sense of responsibility for their future success.

There were also two comments to the lack of robustness of some internal assessment results, for example:

It was the fairest thing we could do under the circumstances. Those who have been lazy during the year and not revised for tests but who were planning to revise intensively for the real exams will have a lower grade than they may have got under normal circumstances. There were worries that some students may have cheated on some tests but there was nothing we could do about it really (T3 C13, EoYS).

Sometimes mathematics teachers critiqued the system being used because they understand its inherent flaws:

'As a mathematician I know firmly that there is no way to predict what exactly the students would get...I felt under pressure to err on the more favourable side as I was questioned repeatedly how I could prove a student definitely wouldn't have gotten one grade higher' (S172, GR TS);

'Every year group is different, every pupil is different and trends don't always apply year on year' (S207, GR TS);

'Because as much as I used historical data and my knowledge of the pupil, there are always surprises as pupils pull out all the stops and pull the rabbit out of the bag for the actual GCSE. They were denied the opportunity of doing this and I found the decision process very difficult and the responsibility of making these decisions weighed heavy with me' (S90, GR TS).

At least one centre's teachers had experienced pressure from management to deviate from Ofqual guidance in producing centre grades:

'We took the ranking more seriously than the grading, given that the grade boundaries were notional and I would expect them to change a little one way or the other once standardisation takes place at the exam board stage. Our managers didn't see things quite the same way, and at one point suggested that ranking wouldn't be needed even. After spending many hours individually and within subject areas, we then met with the sixth form managers (non subject specialists) and were required to justify our choices. This was particularly difficult for some students who were either lacking evidence (averaging assessment grades isn't fit for purpose when some important assessments are missing entirely) or who had been disengaged for some time previous to lockdown and whom we knew would not pass the course. During one particularly gruelling 3 hour meeting we were criticized for our 'integrity', and told that our priorities were different from our managers', who were keen to put forward a picture that didn't have so many U grades, etc. Having read the DfE guidance carefully, and having thoroughly agreed with the process, it was difficult to have to defend our professional

judgement when managers were concerned that this or that parent might complain based on UCAS predicted grades, or that our department might not look so good. We tried to stick to the DfE guidance, which I think represents the fairest possible approach under the circumstances’ (T2 C12, EoYS).

This substantial response does show how seriously many teachers took this process, how significant subject-specific knowledge of students in relation to the subject is, and how difficult it is for teachers to maintain a professional integrity in the light of pervasive performativity pressures. In the light of Summer 2020 events, it would seem that following senior management thinking in this centre would indeed have resulted in students receiving higher grades than the evidence, and teacher past professional experience with similar data, would warrant. Teachers’ response to such apparent anomalies will be sought during Autumn 2020.

3.4.4 TEACHER CONFIDENCE IN THE RANKING PROCESS

A further three mathematics study teachers were not involved in ranking students, so responses were received from 24 teachers. Almost all of these said they felt at least moderately confident in the ranking process, though two were more muted:

‘I am confident about the ranking as it is evidence based. There will always be students who would have over/under performed in an exam compared to the year but we will be correct for the majority of students’ (T2 C13, EoYS);

‘Very confident as our internal assessment system is comprehensive. No exceptions as we have taken every circumstance of each student carefully including missed assessment’ (T2 C6, EoYS);

‘Confident. No exceptions to data-based ranking except for absence from assessments. Extrapolation used for those’ (T1 C6, EoYS);

‘I am confident with the ranking as far as their work so far is concerned. Those who rely on hard work towards the end of the course have probably been disadvantaged’ (T2 C4, EoYS);

‘I feel confident. The ranks were already in a good order, so I had very few changes I wanted to make’ (T1 C4, EoYS);

‘The ranking process was very clear. We had a lot of data to base our decision on and we have a good understanding of where pupils lie in comparison to each other’ (T1 C2, EoYS);

‘Reasonably confident. Thanks to our Year 11 to 13 teaching structure, I knew all the students entered for the A Level exams well which made it reasonably possible to compare between classes’ (T1 C1, EoYS).

This was echoed in the cross-curricular survey, though less robustly: 62% of responding teachers felt at least reasonably confident in the ranking they had produced. However, the main issues raised were in relation to GCSE, not A Level, mathematics: all students study mathematics to age 16, so there is a larger cohort; a grade 3, 4 or 5 has a particular significance for the progression of the students and the school’s position in league tables; students take Mathematics GCSE in different year groups; and tiering made it more complicated. Where A Level teachers in the mathematics study teachers reported challenges, these were usually in relation either to students who had apparently performed at a very similar level, or they

were referring to difficulties in ranking across different mathematics classes, especially in larger centres, although one teacher referred to the limited time available to get to know students in post-16 centres:

'This was difficult as we often only know our students moderately well (as a college we have approximately 100 A level students and we only have them for 2 years)' (T3 C12, EoYS);

'The ranking was hard, really differentiate rank for students who had the similar results and they were similar standard in the classwork. The biggest problem were for the grade D ranking' (T1 C8, EoYS);

'Not very confident, almost impossible to rank students from different classes taught by different teachers, especially on grade boundaries' (T1 C7, EoYS);

'Difficult with different classes being ranked together' (T1 C5, EoYS);

'This was an extremely difficult process, particularly with multiple classes and teachers of students. We very much opted for a data driven process on this front' (T2 C9, EoYS).

One teacher, though, identified the comparison of students with very different working habits as problematic, and another pointed to year 14 A Level resit students:

'I felt more confident about the ranking than the grading. Where I was less confident was when we would look at two students of a similar level, one who worked extremely hard throughout though maybe lacked some confidence and "natural ability" and one who had the ability and confidence but who maybe did not work as hard. This sort of situation made it hard to decide who was above the other' (T2 C10, EoYS);

'Very confident. However, it was difficult to place the Y14 resit students' (T2 C11, EoYS).

However, teachers sometimes pointed to assumed bases for ranking that are not in fact well supported by evidence: for example, the correlation between GCSE grades and A Level grades is historically positive, but not very strong, particularly in distinguishing between two individual students:

'Ranking process was fair - use of GCSE grades as well as two internal exams were used' (T2 C10, EoYS).

3.4.5 TEACHER PERCEPTIONS OF FAIRNESS IN CAG RELATED PROCESSES

Ten of 28 respondents in the mathematics study thought the process used had been fair to all students; the rest identified some groups of students they thought had probably been poorly served by the resolution adopted, though these were largely groups already identified in previous responses:

'Students who didn't have the strongest AS teaching and were beginning to make real progress. These are often the students who make large gains in the final term before the exam' (T1 C1, EoYS);

'Students that had periods of absence during the year and those starting to make real progress just before school closed' (T2 C1, EoYS);

'There are always one or two pupils who have trouble with internal assessment but build up the momentum needed to reach higher grades in the final stages of the year. There is no way to predict who this may be and how successful they may have been. In addition we have put a lot of intervention

and adjusted processes significantly to improve outcomes at A Level. As results will be verified based on prior data our ability to improve pupil outcomes is effectively capped at the risk of disadvantaging every pupil if we are judged to have increased too many grades' (T1 C2, EoYS);

'Students that up their game before the exams and don't have "good" data throughout the year - might be work ethic, or might just be that 'the penny drops' as they pull it all together' (T2 C2, EoYS);

'Those that had taken a little longer to understand concepts and perhaps weren't ready to showcase this during the mocks as they were soon after we had finished the pure content and hadn't yet started the year 2 applied' (T1 C3, EoYS);

'Many D grade students take time to absorb the concepts and need time to practice to move further. These students are slow learners but have determination and perseverance (like me) and they do well if they have an extra year to complete A levels' (T1 C8, EoYS);

'From experience, some students would perform better at the end of year exams by working harder and in preparation for real exams' (T2 C8, EoYS);

'We know that some students really 'pull it out the bag' in the final exam and take everyone by surprise. With the 2020 grading process, this has eliminated this opportunity for those students' (T2 C9, EoYS);

'I believe many in the class did not put in a huge amount of effort throughout year 12 and year 13, though still did ok, with the belief that they would switch it on in the last term, do lots of "cramming" and work really hard. I don't think this is the way to do it, but they shouldn't be punished for working like this if they are told it is within the rules of examination. Though these students were given reasonable grades, I believe some would have really pushed for higher in the last term and actually achieve very high grades. We were not able to reflect this in our grading since we could not say it was "likely" for any particular student. However, I do believe it was likely that 1 or 2 students in the class would have behaved like this and done well in the last term' (T2 C10, EoYS);

One teacher felt that the whole system had been unnecessary and had been of a potential disadvantage to the range of students (and that will certainly be true if the system actually adopted does not have the confidence of end-users):

'I feel it was unfair to all students as conversations with them suggested they wanted to sit the exam and get a grade that was a true reflection of where they were at' (T1 C12, EoYS).

Another raised the question of what we should be valuing in A Level grades:

'Some students perform better in class than in exams, and I feel bad for those who might have been lazy during some of year 13 but may well have 'pulled it out of the bag' come exam time. On the other hand, those who work hard and have a good grasp of the content but are at a disadvantage in a stressful exam scenario for whatever reason will have had an advantage through this system. That's not necessarily a bad thing, I think - the exam system is intended to give an indication of ability, as is this grading process, and neither are perfect. And if a student would do better in an exam, they can still sit it next year' (T2 C12, EoYS)

Yet another made comments that effectively pointed to the limitations of the way in which their centre had used data, when they could have chosen otherwise:

'Hard working students I knew were going to revise ridiculously hard but had not hit the grades yet in current tests' (T1 C13, EoYS).

Such comments were echoed in the cross-curricular research, though with only 64% of mathematics teachers thinking it was 'fair' or 'very fair' to assess students' outcomes in this way, while 8% thought it was 'unfair' or 'very unfair'. Again, responses might well have been skewed by the fact that many were responding in relation to GCSE mathematics, where there were distinctive challenges as identified above.

As with other teachers, mathematics teachers in the cross-curricular research believed that certain groups of students could be advantaged or disadvantaged by this process. Many believed that girls would be advantaged by it because they tend to work harder during the year. Also, some girls and other students who suffer from greater anxiety during the exam season, including those with mental health problems and SEND, were more likely to benefit from the CAGs, which perhaps seem fair. Mathematics teachers reported that:

'Girls will have an advantage as they are more likely to revise for mocks in my experience' (S108, GR TS);

'I think some students with mental health issues may be advantaged (at least in my class), due to the fact that some may not have worked as well under the pressure of exams as their teachers predicted' (S128, GR TS).

There was a longer list of groups of students thought to risk disadvantage. These included students who don't take mocks seriously; students (especially boys) who work hard in the weeks before the final exam; students with SEND who didn't have proper access arrangements in mocks; students with low attendance figures; students at schools with high staff turnover and/or less experienced staff; students at schools with previously poor results or improving schools; and students whose teachers have an unconscious bias against them on the basis of race or class.

'I worry that students with low attendance may not have had adequate evidence available to prove their ability' (S124, GR TS);

'Underachieving boys who may have had a last minute push as they take the 'real' exams more seriously' (S13, GR TS);

Again, it will be interesting to see how teachers perceive the eventual process adopted in Summer 2020. Arguably, where centres acted on information given at the time and moderated their CAGs to reflect previous achievement patterns, their students will have been disadvantaged compared with those who were aspirational in their CAGs and left Ofqual to oversee moderation of those.

3.4.6 RELATIONSHIP OF CAGS WITH HISTORIC PERFORMANCE

Teachers in the mathematics study reported that nine of 12 centres had made some effort to moderate the CAGs in relation to historic performance, although they had done that in different ways, particularly if last year's outcomes had been out of line with those expected. Of course, that raises questions about whether the CAGs are reflecting the knowledge and skills valued in the new A Level, since last year was the first year of mass entry for this specification:

We have taken a long term trend as the last year's results were out of line (T2 C6, EoYS);

We used historic progress scores to 'sense check' our results. We felt progress scores should be similar as we had a similar teaching team. Luckily this matched up well with our original predictions (T1 C1, EoYS);

We have looked at prior attainment bands and compared these to ALPS targets and L3VA expectations. We have aimed largely to keep these attainment bands And progress outcomes in line with previous years. This has in some cases involved moderating pupils grades down. We have where we feel we can justify it kept pupils' grades where teachers have set these but only where internal data supports the given grade (T1 C2, EoYS);

We read the guideline so we knew that students' grades would be adjusted by examining boards if we did not: we would rather do that ourselves than leave it to Ofqual and hope it's done fairly (T1 C8, EoYS);

We looked at attainment and progress figures from last year and tried to generate predictions that were reasonably inline with this. We were expecting improvements upon last year so incorporated that also (T2 C9, EoYS);

We aimed for the department to set grades that were the average of the last 3 years +5% given that their GCSE average was higher than previous cohorts (T2 C11, EoYS);

Over-inflation of grades is commonplace and it was important that the outcomes were similar to previous years to assist with the standardisation process (T1 C12, EoYS);

Initially our managers wanted us to assign grades based on the Edexcel A-level exam's grade boundaries from 2019, and took some convincing that our internal exams were not comparable. Eventually we went with grade boundaries that correlated pretty closely to the grade boundaries we set for our internal exams (80% for an A, 70% for a B, etc), and made some adjustments where it appeared there were too many of a particular grade (I certainly had a tendency initially to label students as C grade rather than D, etc). In the end, the profile was similar enough to last year, but of course not identical (T2 C12, EoYS);

We had to be close to the outcomes of last year. College also used the ALPS system to compare our CAG's to last year's data. We also used 3 year averages as a check (T2 C13, EoYS).

Teachers at two centres did not know whether any adjustment had been made following submission to their senior management of teacher-assessed grades:

I was not informed (T1 C11, EoYS);

Actually, I don't know. I submitted them - no idea whether they were later adjusted or not but I assume I would have been told if they had been! (T1 C10, EoYS).

3.4.6 STUDENT PERCEPTIONS OF CAGS

The mathematics study solicited year 13 student feedback over late March to the end of April, 2020, so that at the times most students completed the mathematics survey, they knew very little about the proposals for producing CAGs – and that uncertainty was reflected in many of their responses, as reported. In contrast, the cross-curricular year 13 student survey in May 2020 was able to capture 91

Mathematics A Level student responses, though these were disproportionately from sixth form colleges (74% of all responses across subjects).

When asked about their understanding of the process through which grades were being awarded, students gave a broad range of responses. A minority of students gave comprehensive explanations of how grades would be awarded:

'Teachers will estimate a grade for us, based on work done throughout the two years, mock exam results, and our work ethic. They will then rank order us within each grade, according to how likely we are to achieve that grade. The exam boards will then moderate this grade, based on the school and cohort's prior attainment' (S262, GR SS).

The majority had a more partial understanding, sometimes indicating one or more source of information that they felt teachers would use to inform grades but without describing wider context such as moderation by centres or AOs:

'They will be decided upon by our teachers based on how they think we would have done in the actual exams' (S3, GR SS);

'I will be given a grade and ranked based off the opinion of my teacher' (S223, GR SS);

'Predicted grades via our teachers' (S242, GR SS).

A small number of students had little understanding of how grades would be awarded.

'I have very little understanding, I presume it's just using our predicted?' (S214, GR SS).

Communications about such issues had varied: the majority of students had received emails from their centre informing them about the process of awarding grades. These had often repeated information from Government documents or included links to the Government website or Ofqual:

'I was given an overview and sent official documents which explained the process' (S292, GR SS);

'The college sent constant updates in the form of emails linking government websites that detailed how this was being done' (S7, GR SS);

'Our teachers constantly provided us with updates from the government so that we would be well-informed despite the coronavirus lockdown' (S3, GR SS).

Others had been briefed by teachers in addition to email communication:

'This was explained by several subject teachers. They have explained that we will not find out our grades until results day' (S133, GR SS);

'We had discussions with tutors and teachers as well as emails' (S120, GR SS).

Only a very small a minority of students felt that they had received very little information from their centres:

'Our school sent a few vague emails' (S227, GR SS).

Many had also accessed other sources, with 71% of the 91 responding A level Mathematics students saying they had accessed a government website while 34% used the Ofqual website. News media were cited as a source by 53% of A level Mathematics students and social media were used by 46%.

Responding students varied in their rating of the fairness of the process as they understood it, with 21% rating it 'unfair' or 'very unfair' and 42% considering it 'fair' or 'very fair'. Students who gave a higher rating for fairness often suggested that the process was the best solution given the challenging situation:

'I think the system is the best that can be applied given the current situation, but obviously isn't perfect' (S6, GR SS);

'I think it was fair under the circumstances' (S43, GR SS);

'I think it's the best and fairest option given the circumstances' (S55, GR SS).

One student felt that the system had some advantages over sitting exams:

'Many people put in more effort coming up to exams but this is not taken into consideration' (S4, GR SS).

In another key theme, student commented that mocks were often not taken as seriously as external exams and therefore did not represent a fair assessment of students' potential:

'Different schools and colleges set different mock exams with different grade boundaries. Mock exams were never taken seriously, if we knew they would determine our grades more work would have been put in' (S11, GR SS);

'I feel psychologically people are more laid back when it comes to mocks even though they believe they are 100% revising. We are always taught how what matters is the final exam, however I believe that they've disregarded this.' (S26, GR SS);

'Some mock grades may have been a lot worse than the results that would have been achieved through normal testing, so the grades based on this would not be reflective' (S103, GR SS).

There was also concern from at least one student that teachers may be biased in their decision making:

A teacher's belief in a student may be skewed if the teacher dislikes said student for reasons out of the student's control' (S10, GR SS).

A small number of students also cited individual circumstances which were not taken into account by the awarding process:

'I enrolled onto my maths A Level course mid-way through college and although I was happy with my predicted grade prior to lockdown and on track to achieve this, I am concerned that results of my early class assessments and work did not reflect my full potential due to the fact that I had to catch up with the syllabus following late enrolment into the course' (S34, GR SS);

'I personally feel as though I would have tried my absolute hardest during exams to get the grades that I want as it's the real thing and I'm not sure some of the teachers know that so I may get lower grades than I know I could have achieved' (S151, GR SS);

'Some teachers will not know how hard I was working at home since our last exams to improve and also the fact I am a very quiet person will have given the impression I am less interest and so less hardworking within my subjects which is not the case it's just my personality' (S141, GR SS).

One student also commented on a sense of having missed out on the opportunity to take their exams:

'Not having a chance to prove ourselves and not feeling like we have properly earned the grades' (S114, GR SS).

These responses indicate the diverse range of factors which underpinned A level Mathematics students' perceptions and expectations of the awarding process.

3.4.7 CAGS FOR AEA

AEA is the only surviving Advanced Extension Award, and is offered to further test high-achieving students on the content of Mathematics A Level. Only three of the 28 teachers responding to the mathematics

study had had dealings with AEA CAGs, and no responding students referred to AEA. In each case they expressed a lack of confidence about the grades assessed:

'Not confident as no mocks completed: mid-March was very early in the process of preparing for AEA and I have little idea how students would have progressed in the extra time they'd normally have had' (T1 C9, EoYS);

'Not confident at all - we had not completed any mock exams with these students so had no data to draw upon – far too early to say' (T2 C9, EoYS);

'Less confident. Due to the small number of students this was done by teacher judgment as we had

This high level of uncertainty reflects not only the patterns of teaching and learning for AEA, but the typically small entries, and unusual nature of appropriately-entered students. There is no incentive for teachers to under-estimate student progression from March to AEA examinations, and JCQ statistics show just how far the resultant CAGs deviated, overall, from the 2019 awarded grades: In 2020 CAGs produced 31.9% Distinction as opposed to the 12.3% awarded in 2019. They resulted in 79.2% Distinction or Merit, as opposed to the 45.1% awarded in 2019. Further, such outcomes were awarded to students many of whom, according to the data reported earlier, are likely not to have engaged in much of the learning planned to focus on developing skills and knowledge to tackle AEA.

3.4.8 POST-LOCKDOWN INTERACTIONS WITH PARENTS AND STUDENTS IN RELATION TO CAGS

18 of 28 teachers in the mathematics study said they had had 'no' or 'very little' interaction with parents or students around the CAGs, in several cases attributing this to clarity of communication from the centre:

'No response as the school made it very clear to them' (T2 C6, EoYS);

'We have made the process, and constraints on sharing the assessed grades, very clear, so no' (T1 C7, EoYS).

The other ten teachers noted some interactions, often from students, or their parents, either who were concerned about opportunities to resit, or who felt they had not been performing to potential through the course, or perhaps in mock examinations, and who were concerned their CAG would reflect this:

'Some questions early on about how the process would work (mostly I reiterate our guidelines, refer to the DfE documents and reassure them that there will be a resit opportunity). Some queries about resits or extra bits of work completed and whether they will be considered (yes, as your teachers we'll look at all available evidence whether it is easily quantifiable or not). The only direct communication from a parent was for a year 12 student from the Fast Track group who had already chosen to be entered for A-level Maths this year, but again I was able to reassure them based on the DfE guidance' (T2 C12, EoYS);

'Students were very worried about the grading especially those who did not performed well so far' (T1 C8, EoYS);

'Pupils are concerned - despite what they are told they don't take mocks as seriously as they should and some feel that their mock is no reflection of what they would have achieved in the real exam.

Those who I have bumped into I have tried to assure that we have considered as much as possible and been as fair as possible. Some are more concerned than usual about whether they will get into uni as they think they would have performed better in the exams' (T1 C10, EoYS);

'Less than expected. A few worried students pleading that their mock scores did not reflect their potential. A few parents asking for a complete list to the information being used' (T1 C13, EoYS);

'Nothing particular. Pupils have indicated their worry about the process and the stresses this has caused them' (T1 C2, EoYS);

'Early on we had a lot of students who were worried and sending lots of emails. We had some communication from tutors offering to provide evidence of students work in tutoring' (T1 C1, EoYS).

The only other group mentioned as particularly concerned, was those students resitting, who had a different evidence base from those taking A Level for the first time:

'Many students were initially concerned, particularly students who were resitting and had not been in school in order to demonstrate their progress. We have not had any concerns raised from parents' (T2 C9, EoYS).

3.5 CENTRE PLANS FOR AUTUMN 2020 TEACHING AND LEARNING

All data in section 3.5 are drawn from the mathematics study.

In July, about half of teachers did not have clear plans for Autumn teaching. Many were preparing for dual routes, or for some form of blended learning, with variable balances of face to face and distance teaching, although some expected 'business as usual'.

Nearly all anticipated challenges in assessing and addressing gaps in learning, and while that was more pronounced for the incoming year 12, building on GCSE grades of unknown robustness, there were concerns about time pressure for year 13. Planned responses were largely around additional interventions and tweaks to pedagogy, with perceptions of little scope for major changes.

Teachers requested additional secure assessments, and further provision of new-style questions.



3.5.1 ANTICIPATED CHALLENGES FOR THE AUTUMN TERM

All responding teachers identified challenges for the Autumn term, often for both year 12 and year 13. At least half voiced concerns about the incoming year 12: the depth and breadth of their GCSE learning, the grades assessed not being representative of the level at which they would be able to work, and students' recent lack of experience with working habits, particularly in terms of writing:

'We anticipate year 12 algebra skills will be poor in comparison to previous years – they had no chance to consolidate learning' (T2 C2, EoYS);

'There will be a wide variety of gaps in their knowledge. Normally we can anticipate the 'sticky' topics and guide revision accordingly, but next year it will be very different for each student' (T2 C9, EoYS);

'Making sure students are fully ready for the A level both for the content and getting back into a working routine' (T1 C3, EoYS);

'For both year 12 and year 13 we'll have more revision built in to scheme to consolidate work done at home' (T2 C4, EoYS);

'Year 12: not completed syllabus of higher tier topics and having a big gaps in knowledge required for A level standards' (T1 C8, EoYS);

'Perhaps a lack of confidence feeling as year 12 students might not think they are capable of studying A-level maths as their GCSE grades are not justified in their eyes' (T3 C9, EoYS);

'They will be so out of practice in their written work. I think they'll struggle a lot more on the basic skills required to access the course. The challenge will be the lack of time available to us to get these skills back to where they should be as well as cover all the content' (T2 C10, EoYS);

'Students predicted grade 7s who may have an actual GCSE level of a 5 or 6. Assessing the knowledge they will be coming in with will be the most challenging aspect, and responding to this with appropriate resources and teaching in an already time constrained timetable' (T1 C12, EoYS);

'Year 13 will be happy to be back in class. There will be gaps, but I don't worry that they will respond well and get on. Year 12 are a much bigger worry. They will have massive gaps and have had 6 months to get out of the habit of working' (T1 C13, EoYS).

Note that concerns around GCSEs were expressed even before the events of Summer 2020: teacher views on the perceived impact they are seeing will be sought in Autumn 2020, but the cohort-inflated awarded (non externally-moderated) grades might actually exacerbate the concerns expressed in July.

Concerns around year 13 included unknown gaps in learning, and consequent time pressure:

'Some of our Year 13 students are going to need a lot of support to catch up: I don't think they've been able to engage in depth, and over sustained periods, with distance learning – not necessarily because they can't access the software or hardware, but because it's hard for a 17-year-old to motivate and organise themselves without the easy support of a group or a teacher, particularly around deeper learning' (T1 C1, EoYS);

'The biggest challenge will be dealing with those – in year 12 and year 13 - who have done nothing or very little since the start of lockdown' (T3 C13, EoYS);

'Greater time pressure in year 13 to cover the course and need to take things more slowly with a potentially weaker year 12 cohort' (T1 C7, EoYS).

More strategic, as well as personal, concerns were also expressed:

'Students will be required to be more self-sufficient as the contact time will be largely limited to timetabled periods. This is especially challenging given their 6 months break from intensive mathematics learning' (T2 C6, EoYS);

'Both years: social distancing in classroom (minimum chance to have pair or group work) and also teaching in 'shifts' might have an effect on assessment and syllabus delivery (I don't want even to think about it!) Weaker students would be needing more help, how they can have someone helping if they have to be 1 m away?' (T1 C8, EoYS);

'In terms of teaching, it will be hard I think to plan and prepare good quality flipped learning resources in addition to the classroom teaching I'll be doing. In terms of my own situation, I don't know how my kids' school will be affected, and what will happen when/if I or they have to stay off. There will need to be something more robust in place than current cover procedures, for starters' (T2 C12, EoYS);

'Getting the students back into a routine will be challenging especially for Year 12 who haven't had the same level of remote learning from March - we expect many to have not had remote lessons this term. Attendance could be an ongoing concern with local outbreaks & track and trace isolations etc' (T2 C13, EoYS).

3.5.2 HOW WILL PLANNED LEARNING BE DIFFERENT FOR YEARS 12 AND 13 IN AUTUMN 2020?

When they completed the survey in July, nearly half the responding teachers did not have a clear idea of the extent to which they would be able to adopt 'teaching as normal' approaches for the academic year 2020-21. Some were doing double preparation to cover contingencies of largely face to face or largely online teaching, some were preparing for a blended learning approach of some kind although they did not at that point know the details of what would be expected, and some were expecting to be teaching 'as normal', dealing with local lockdowns or centre closures as they arose:

'We are planning to teach them in school as normal though we will have to hold catch-up sessions throughout the term. This will be to secure year 12 students on basic concepts such as quadratics, and to ensure year 13 students feel confident with calculus prior to starting year 2 work' (T2 C3, EoYS);

'We have 3 times 1.5 hour lessons. We're not sure what we'll be doing, so have to prepare for a variety of scenarios. Probably mixture of lecture (student not in class listening online) for 20 min and then practice with students in the class and again continue with 20 min lecture and practice again. Students online will continue with practice but won't have chance to ask (they can use to discuss questions in Teams). Who knows? we need to try and see what works best' (T1 C8, EoYS);

'We might consider dividing classes into two groups, teaching one present in classrooms and the other one on-line at the same time set up in lessons, then the groups swap for the next lesson?? We're going to have to be ultra-flexible' (T2 C8, EoYS);

'The key difference will be the pace of teaching will need to slow down to help overcome misconceptions that students may have self-taught – but there's a strict limit to how much we can do that – even in a normal year we don't have much time to spare' (T1 C5, EoYS);

'We have kept the scheme of work the same as there is little flexibility in it and it develops their mathematical skills logically. We have set up lessons for the whole year on our study directory so that students can easily find missed work etc.' (T2 C13, EoYS);

'We are not planning to do anything radically different in the way we approach most of our curriculum (lessons, home learning). We will put in more early interventions in Y12' (T2 C11, EoYS);

'Blended learning - preparing to deliver both online and face to face, we don't know when or how, so we need to be flexible. More planning to take place via Microsoft Teams and sessions focusing on digital skills to best support learners' (T1 C12, EoYS).

A common theme, voiced by at least eight teachers of the 28 responding, was that teachers felt there was little scope to deviate significantly from their usual plans, despite the likely challenges identified above, for mathematical as well as time constraint reasons:

'As the lessons will be in person again, and there's not a lot of 'wriggle room', I don't expect it to be very different unless there are drastic changes to government guidelines over the Summer' (T1 C4, EoYS);

'We will have a similar approach as otherwise we will waste too much time and would be a detriment to students' (T2 C2, EoYS);

'The only real difference will be to work more slowly through the introductory chapters in year 12. I would expect the outward appearance for year 13 to be the same' (T1 C7, EoYS);

'I have spent some time during lockdown revising A-level materials. I will be introducing more regular short tests. I am trying to find appropriate online resources which pupils can use to support learning. But, generally, teaching will be the same - it has to be to get through the content' (T1 C10, EoYS);

'It is likely that we will be using a blended approach as a college where the students do an average of 1 lesson per week face to face when we can and 2 remote. I have spent a long time getting material ready for remote lessons on the website asks each lesson now has one or more videos, textbook references and exercises for the whole year. Even if we can have more face to face, those won't be wasted' (T3 C13, EoYS).

Just one teacher here had identified topics felt to be appropriate to distance learning, so had reorganised curriculum planning to allow for prioritising 'face to face-critical' topics when students were in centre:

'We have no timetable yet, so I am not planning specifically, but I have been thinking about which topics might be more appropriate for online learning, and video resources to support this so I don't have to make all of my own (for example the start of Y12 stats is a lot of repetition of GCSE so this work could be revised from home with guidance rather than in college)' (T3 C12, EoYS).

Some, though not changing their planned curriculum, anticipated changed pedagogical approaches somewhat, to accommodate the likely challenges described above:

'We have added an additional class in Year 13 so we have smaller class sizes so students can get more time with their teacher. We will also run after school sessions for students to work through the old resources on the Google Classroom if they haven't already' (T1 C1, EoYS);

'Year 13 - some struggling students being put in classes with increased teaching time from day 1. Year 12 - no changes. There are always some that struggle with the step-up. This year there will be more that struggle. We will support them, but will not hide the reality that there is a big step-up to A level Maths. If we spend too long cushioning the start of the course we will simply push the problems into later in the year' (T1 C13, EoYS);

'We will not be adjusting schemes of work etc. We will however be increasing our expectations on teachers to provide adequate intervention. This will be more teacher led and guided than historically' (T1 C2, EoYS);

'For now we are planning to approach it in the same way, however we will need to be mindful of the fact that students may struggle and may need some intervention' (T1 C3, EoYS);

'Homework assignments will have more review questions' (T2 C4, EoYS);

'There will be a greater emphasis on independent learning. Students with difficult technology access/insufficient technology provision will have to be further supported with additional written materials' (T2 C6, EoYS);

'I am planning to include a lot more short testing, and being harsher on lack of work submitted. I hope to get support from higher up in the school to do this' (T2 C10, EoYS);

'Set independent reading and give a preparatory video perhaps for their first lesson, and have them access and tackle the key elements of the topic before their first contact time. Then maybe the group split in two so I see each as a smaller seminar group once a week to go through problem questions and address any issues arising from the tutorial videos. That way we can adapt for whatever the Autumn term throws at us' (T2 C12, EoYS).

Just one, at this stage, identified positive outcomes from the centre closure period, though that is hardly surprising given what else teachers were having to think about in July:

'We have learnt a lot from this period, particularly with the use of online resources - we hope to embed this into our practice more next year' (T2 C9, EoYS).

3.5.3 ADDITIONAL RESOURCES NEEDED FOR AUTUMN TEACHING AND LEARNING

All except two of the 28 responding teachers identified additional resources they would find helpful moving forward. They commonly (in at least ten cases) referred to additional questions of a 'new exam style' that assess problem solving and reasoning in rather more demanding ways than those on the previous specification assessments, and/or additional practice or 'mock' papers:

'More practice/mock papers - there are still not enough papers for schools to use as mocks and to give to students to practice from and I feel this is a huge issue when it comes to revision' (T1 C3, EoYS);

'Access to more exam-style questions. The ones in the textbook are all clearly topic based, but exam questions always link more than one topic together' (T1 C4, EoYS);

'More practice papers with problem solving for students (this was raised also in our interview by students) as students can work on all questions available for them but exam questions are so much different' (T1 C8, EoYS);

'More specimen papers for AS further maths' (T3 C13, EoYS).

Another common request was for publication of another secure set of papers, given that Summer 2020 papers will not be available. Note that teachers commonly still do not understand how grade boundaries are established:

'I'd like to have this year's exam papers released (securely to teachers) when possible. I'd also appreciate extended ActiveLearn access until the Autumn exam series has passed. We only have enough accounts to cover Year 12 & 13 and will need to provide access to the outgoing Year 13 who choose to sit the autumn exam series' (T1 C1, EoYS);

'Ideally we would have access to the 2020 papers, markschemes and grade boundaries asap' (T2 C11, EoYS);

'Given the possible importance of any assessment data in potential CAG's (I'm really hoping we don't have to do them again but..) new secure tests/exams papers for Maths and FM would be great - students won't have seen them before so cheating would be reduced and the results more reliable' (T2 C13, EoYS).

Several teachers also asked for more chapter- or topic-based video or other resources:

'Powerpoint files to accompany topic assessment' (T2 C6, EoYS);

'Short chapter tests with 2 exam-style questions' (10-15 min) (T1 C8, EoYS);

'I would love to see video resources for topic by topic revision that can be shared with students. We also need locked papers available for assessment usage as we will not have the 2020 papers to use for assessment' (T2 C9, EoYS);

'Video revision lessons, videos to go with each chapter - freely available; 20min tests to go with each chapter in the textbook' (T1 C10, EoYS);

'I would like graded topic sheets (e.g. Functions grades B/C and Functions grades A/A) and more questions where the specification and style differs radically from the previous version' (T2 C11, EoYS);*

'It would be great if there were some solution videos to augment the excellent resource of solution bank. It's the extra discussion around questions - what to look for, how you know what to do, etc, that is missing from a standard (even thorough) written solution. That's so important when students have to work independently' (T2 C12, EoYS).

One teacher mentioned particular areas of the curriculum:

'Activities to help understand calculus' (T2 C3, EoYS);

'We have missed out on time that we may have spent on LDS projects, so more online large data set resources that students can work through independently would be useful' (T3 C12, EoYS).

Unsurprisingly, given the many unknowns surrounding incoming year 12 students' active skills and knowledge, several teachers asked for further support in supporting transition to A Level:

'Assessments on GCSE skills that are required for A-level, paired with worksheets that can be completed following the marking of these tests' (T2 C10, EoYS);

'Induction packs for year 11 transitioning into year 12' (T2 C3, EoYS);

'Activities to help understand calculus, induction packs for year 11 transitioning into year 12' (T2 C3, EoYS);

'Online assessments that are self-marked to help with the assessment process/evaluation of the new year 12 students' (T1 C12, EoYS).

It is interesting that, as reported in section 6.3, so few teachers appeared familiar with the newly-produced AMSP support materials designed for such purposes. Two also asked for extra materials supporting 'catch-up', without apparently being aware of the unlimited parameters for such a request:

'Supplementary material to support gap-filling, e.g. some extra question banks' (T2 C7, EoYS);

'Catch up scheme of work and resources to plug the gaps in knowledge' (T1 C6, EoYS).

Finally, two had more strategic requests:

'We really want the practice books included in the Active Learn package' (T1 C13, EoYS).

And, just to show some teachers appear to have almost unlimited faith in Edexcel:

'We need to know how exams will look like in the coming two years' (T1 C11, EoYS).

Two teachers were still asking for publication of the totality of known solution errors and specification mismatches in key resources:

'Publishing a list of errata for the textbooks/answers on the website, especially the further maths resources....Ensuring all further mechanics chapter tests are fit for purpose - some AS tests covered additional content' (T1 C7, EoYS).

Finally, teachers made several requests relating to workbooks or practice books:

'Publication of extra mock papers, solution bank for workbooks' (T2 C1, EoYS).

4 IMPLICATIONS AND CONCLUSIONS

4.1 IMPLICATIONS FOR HODS AND TEACHERS IN CENTRES

- It is clear that year 11 students coming into mathematics A Levels are likely to have more than usually divergent year 11 experiences and mathematics learning, requiring skilled, deeply subject-knowledgeable formative assessment to address. Many students will come to A Levels without having experienced structured and focused completion of the GCSE specification and synthesis of GCSE learning. This is particularly challenging for the focus A Levels, which our mathematics study shows are highly aspirational and time-pressured, for most participating students.
- Such increased uncertainty around students' current mathematical functionality brings an increased need for transition support, which might be difficult to provide at a time of increased teacher and student absence due to local virus outbreaks. The demands of adjusting to new ways of working at the same time as catching up on missed teaching time may be an additional barrier to this.
- Many students coming into year 12 will be out of the habit and organisation for daily schoolwork and related independent learning, though they might also bring new and positive capacities and learning from the home schooling period. Given the depth and breadth of mathematical learning required in the reformed A levels in mathematics, our findings show that students' motivation and capacity for independent learning is increasingly key their success.
- Students who enter post-16 education without a 4+ at GCSE are likely to be particularly weak compared with previous cohorts – and might well bring resentment about not having had the opportunity formally to demonstrate what they can do.
- The increase in centre-assessed GCSE grades compared with historical grade profiles brings a risk to participation in mathematics A Levels, since young people, and especially girls, are likely to be influenced in their choice of pathway by their relative attainment (Noyes et al, 2009).
- Year 12 mathematics A Level students also will bring diverse experiences and mathematics learning to year 13, though centres typically already know these students and their relationships with mathematics. Teachers were variably confident about the extent and quality of year 12 learning during home education periods, but again, need to employ highly skilled formative assessment through year 13, in order to address any learning gaps from the pandemic period.
- Evidenced uncertainties in planning for Autumn 2020, and ongoing pressures due to repeated staff and student absences, and constraints on movement, spacing and shared use of resources, will put ongoing strain on teachers and students, and it would be surprising if those did not adversely affect some aspects of teaching and learning.
- As teachers moved further into the home learning period, they did develop their provision for students, and their understanding of the affordances and constraints of remote learning. It is important that such learning is proactively identified and harnessed to feed into future such need, as well as into ongoing use of such learning to complement face to face opportunities.

4.2 IMPLICATIONS FOR UNIVERSITIES

- It is clear from our evidence that many year 13 mathematics students had very little deliberate and interactive building up of experience after centre closures from March. As a result, many students

will come to university without having experienced structured and focused completion of the A Level specification(s) and synthesis of A Level learning.

- Because of the evidenced aspirational and time-pressured nature of the specifications for mathematics A Levels, it is likely that students whose university courses rely on learning related to those A Levels will be particularly badly hit.
- The uncertainties surrounding the meaning/accuracy and comparability of the CAGs awarded for A Levels, coupled with, for many students, an unusually long period between routine engagement with A Level work and starting university, suggest HEIs are likely to experience a greater than usual variation in preparedness of incoming students, even if those young people were coming to experience normal university provision, which is not the case. They will therefore need to engage with active and deliberate formative assessment of student capabilities they might normally take for granted.
- Shared understandings of the functionalities represented by mathematics A Level grades under the new specifications, will remain uncertain for at least another year, and probably longer because of the unusual experiences of the new (2020-21) year 13 cohort.
- Teachers expressed much greater reservations about the reliability of CAGs for the Advanced Extension Award, and indeed, 3.4.7 above shows the outcomes represent a very big change from outcomes in 2019. HEIs will need, therefore, to interpret these grades with caution.

4.3 IMPLICATIONS FOR PEARSON

- Teachers of mathematics A Levels generally felt well-supported through the CAGs process, and recognised the changing situation for Pearson.
- Students too felt Pearson messaging was clear, so similar approaches in a comparable situation would likely be helpful.
- Teachers pointed to year 11 and 13 students in particular typically having had very different learning opportunities in 2020, but that is true to some extent for the range of school/college students. It is unlikely that both 'standards' and assessment outcome profiles will be maintainable over the next few years.
- It is worth noting that teachers generally felt confident about their initial production of mathematics A Levels CAGs, though less so about D/E assessments, and about ranking, particularly in centres with larger cohorts. The thorough and rigorous strategies adopted by some mathematics departments in producing CAGs could usefully be captured and shared across subjects and centres, in another similar situation.
- Teachers' limited confidence in consistency of CAGs across classes or schools should be noted, as should the pressures from centre leadership or management to change (and typically, increase) those. If there is in a future scenario no expectation that final grades awarded will be moderated to be comparable with historic performance in a centre, then it is likely such pressures will increase. In any case, for a variety of reasons, it is unlikely that teachers/centres would behave in a future scenario exactly how they have in 2020.
- The nature of learning for AEA means it is always unlikely that teachers will be able reliably to predict performance from the preceding March or April.
- Although many teachers, and about half of students, surveyed, felt the initially adopted process (which of course, included an expectation of external moderation after submission of CAGs and rankings), was as far as could be achieved in the circumstances, they pointed to a range of groups

of students for whom the process was likely to result in a different outcome than an assessment-as-usual process would achieve – in either direction. How fair that is, depends on what is being valued.

4.4 IMPLICATIONS FOR OFQUAL AND/OR POLICY

- Ofqual and policymakers/influencers need to be aware of the above implications for centres, for HEIs, and for Awarding Organisations, and to take those into account when making decisions about A Level assessments and grades in Summer 2021.
- In particular, given the evidenced loss of learning opportunity, it is important to note that it will not be possible to maintain both assessment standards and outcome grade profiles over the next few years.
- Challenges to learning opportunities remain as the pandemic persists. It is important that the impact on learning, productive responses to the constraints on education during the pandemic, and the affordances and constraints of remote learning, are better understood and continue to be monitored. In the focus area here of A Levels in mathematics, The Pearson-UCL study will contribute to that as it continues through to September 2021.