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**Theme: Summative assessment**

***'How do you assess that?'* Achieving meaningful engagement with a large dataset as part of a reformed A-level Mathematics.**

### **Short abstract**

Drawing on a four-year study (2017-2021) which explored reformed pre-university A-level Mathematics in England, we outline the extent to which students have been able to meaningfully engage with a large dataset-focused component of this qualification, and ways in which enactment of the specification, as well as approaches to assessment, have influenced this. The implication of shifts in practice during Covid are also considered.

Mathematics/Further Mathematics A-levels, the calculus-rich pre-university qualifications in England, were reformed for first teaching from September 2017. They include greater content-related scope, and enhanced expectations for mathematical proof, problem solving and modelling. They are terminally assessed by timed written papers. As an aspect of modelling, Mathematics A-level students are required to engage with a large dataset using suitable technology. However, curriculum pressures, as well as limited assessment reward for large dataset work, mean that in study classrooms this element was often sidelined. Access to technology, teachers' digital pedagogy and students' IT skills, were also barriers. Pressures associated with covid, and its ongoing impact, then led to further marginalization of the large dataset. Post-covid we saw changes in teachers' practice and attitudes towards assessment that could offer revitalised approaches for engaging with the large dataset in the future.

### **Long abstract**

Drawing on a four-year study (2017-2021), which explored reformed mathematics A-levels in England, we outline the extent to which students have been able to meaningfully engage with the large data set component of this qualification. The research that informs this presentation covered the enactment of the new specification, as well as the impact of the assessments and related resources. It was conducted by an Awarding Organisation in collaboration with an academic. The study included ~20 schools, with two A level classes in each at any time, each followed through longitudinally for two years with lesson

observations, student focus groups, and teacher interviews. Teacher and student voice was solicited remotely during the pandemic.

Mathematics and Further Mathematics A-levels, reformed for first teaching from September 2017, are the main mathematics pre-university qualifications in England. These reformed qualifications are designed to be more aspirational, including greater content-related scope, and increased focus on mathematical proof, problem solving and modelling. Both qualifications are available to year 12 and 13 students in schools and colleges, and are terminally assessed by timed written papers. Mathematics A-level students are required to explore a large dataset using suitable technology (DfE, 2016). The funder, as the largest provider of mathematics A-levels in England, offers a large dataset focused on UK Meteorological Office weather data (~184 records of each of 11 variables for each of eight locations in each year), and provides a suite of associated teaching and learning resources, aiming to facilitate student engagement as well as support teacher data and digital knowledge and skills. A copy of the large dataset is not available to students during the examination, but they may be given a reference extract. This approach was perceived by teachers to be poorly suited to valid assessment of work with the large dataset. Throughout this study, teachers expressed support for the intentions around inclusion of the large dataset in A-level Mathematics and reflected on the importance of associated skills for students' progression to further study and employment, but also expressed concerns about the practicalities of teaching and assessing it. The wider literature, emphasises a current enhanced need for digital and data literacies (e.g. The Royal Society's [Mathematical Futures project](#)), but, also evidences the limited experience, globally, of assessing those within high-stakes assessment cultures, such as in England.

Our findings from 2017-2019 indicated that students and teachers were struggling to cover the broad A-level Mathematics curriculum while maintaining the depth of mathematical engagement required. Further, teachers were concerned about the perceived increased demand of assessments and initially, had uncertainty about expected demand of papers. Consequently, aspects of the curriculum such as the large dataset, which were not perceived as adequately rewarded through assessment, were often marginalised. This was exacerbated in the case of the large dataset by limited access to technology in schools, and where teachers lacked data and digital pedagogy knowledge and skills. Students also often lacked suitable prerequisite skills to engage with the technology required to access the large dataset (Redmond et al., 2019). With the emergence of covid in early 2020, we saw evidence that the

large dataset became further marginalised, with teachers usually focusing on the rapid pivoting to remote learning and the realities of exam cancellation. This impact appeared ongoing to the end of the study in late 2021, with increasing pressure on teachers to alleviate covid-related learning gaps, as well as supporting students with wider impacts of the pandemic.

Post-covid, and building on their assessment experiences in 2020 and 2021, we saw some support from teachers for more diverse modes of assessment, which may offer a way forward for more meaningful assessment of the large dataset work. Movement towards more diverse approaches to assessment was also highlighted in the *Future of Assessment* report (Pearson 2022). Earlier concerns around digital capacity of teachers and student might have been alleviated during the pandemic, since in 2020-2021 we saw greater use of technology to support teaching and learning, some acquisition of digital pedagogical skills by teachers, and improved access to digital devices. Although digital technology used during the pandemic was not often subject specific, this shift in school culture might plausibly support further engagement with the large dataset in future. Researchers should monitor ways in which the large dataset may (or may not) be prioritised in the future, both in the classroom, through changes in teaching practice, and at a policy level through changing approaches to assessment.

DfE 2016, Mathematics AS and A-level content,

[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/516949/GCE\\_AS\\_and\\_A\\_level\\_subject\\_content\\_for\\_mathematics\\_with\\_appendices.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/516949/GCE_AS_and_A_level_subject_content_for_mathematics_with_appendices.pdf)

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