



The independent evaluation of the pilot of the linked pair of GCSEs in mathematics

Third interim research brief

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Introduction

AlphaPlus Consultancy Ltd was commissioned – originally, in March 2010, by the Qualifications and Curriculum Development Agency (QCDA) and then, from March 2011, by the Department for Education (DfE) – to evaluate the pilot of the linked pair of GCSEs in mathematics (MLP). The pilot programme and the evaluation run until December 2013. This research brief reports interim findings from the fourth round of fieldwork, conducted in January and February 2012, and builds on findings from the second interim report.

Background to the pilot and evaluation focus

The MLP qualifications are ‘methods in mathematics’ (Methods) and ‘applications of mathematics’ (Applications). The two qualifications together cover the entire Key Stage 4 (KS4) programme of study (PoS) for mathematics but with some additional content. Neither qualification by itself covers the full KS4 PoS. A new single GCSE in mathematics was also developed for first teaching in September 2010 – the single qualification is ‘nested’ in the pair. Candidates should be entered for either the single GCSE in mathematics or for both qualifications of the MLP.

The single GCSE and the MLP were developed with three aims:

- increasing engagement with and participation in mathematics at GCSE and beyond
- enabling understanding of the relevance of mathematics
- offering opportunities to stretch and challenge all students.

There were also additional wider aims for the MLP. These were to:

- increase student commitment to mathematics, with increased engagement with the subject

- develop greater breadth and depth of subject skills and knowledge by undertaking two GCSEs, with additional content, to prepare students for progression to further study
- develop students' recognition of, and capacity to use, the different methods of enquiry encouraged by having two distinctive GCSEs.

The number of pilot centres at 31 March 2012 was 256 across the four awarding organisations participating: 99 with AQA, 78 with Edexcel, 67 with OCR and 12 with WJEC.

The evaluation investigates four key themes:

- attitudes to mathematics
- comparability of demand of the pilot qualifications with each other and with other GCSEs in mathematics (including the new single GCSE)
- centres' views of the pilot
- the support offered to pilot centres by the awarding organisations.

The fieldwork reported here was undertaken in spring 2012 and builds on previous research findings published in April 2012.¹ This latest round of fieldwork has a greater emphasis on student progression. It looks at how prepared teachers believe students are for progression to further study from the MLP. Centres with experience of the single GCSE were also asked to consider whether they believe students taking the MLP were, or were not, better prepared than students taking the single GCSE in mathematics. The fieldwork also collected data on the expected impact of the MLP on the numbers and groups of students progressing to A level in mathematics or related subjects. Fieldwork has included visits to six further case-study centres (four pilot centres and two single-GCSE-only centres)² and follow-up telephone interviews with ten pilot case-study centres visited in autumn 2011. Across the 14 pilot centres included in this round of fieldwork, 6 are 'joint-offer centres' – that is, they offer the MLP to some of the KS4 student cohort and the single GCSE in mathematics to others.

Some data collection originally planned for this latest round of fieldwork was brought forward and included in the second interim report to align with reporting on the review of the National Curriculum and wider decisions on mathematics for KS4. It should therefore be recognised that any new findings reported here are based on a limited amount of data. It should also be noted that, as is often the case with pilot programmes, pilot centres may not be representative: high-achieving centres and students are over-represented in the attainment data for MLP examination entries seen to date. There is also a higher-than-average proportion of qualified mathematics teachers involved in the pilot programme. It should be noted, however, that many centres report their intention to enter whole-year cohorts of students for the MLP, and there is evidence to suggest that centres have been experimenting with entry patterns. Following the summer 2012 examinations, further data

¹ AlphaPlus Consultancy (2012) 'Evaluation of the Pilot of the Linked Pair of GCSEs in Mathematics (MLP): second interim report, research report DFE:RR207'. London: DFE
<https://www.education.gov.uk/publications/eOrderingDownload/DFE-RR207.pdf>

² Case-study centre visits included interviews with heads of mathematics, mathematics teachers, focus groups with students and classroom observations.

will be available on how representative the pilot centres and student cohorts are of national cohorts.

Key findings

These key findings are based on the limited amount of new data collected in January and February 2012, after approximately 18 months of implementation of the pilot programme. Findings should therefore be treated with caution.

- Where case-study centres saw the opportunity to *introduce* A level materials (pre-calculus material and a higher level of algebra in particular) within the content and structure of the MLP, they generally felt that, in terms of learning, no further 'bridging' for progression to A level was necessarily required, as current content could be extended sufficiently.
- Of the 14 pilot centres interviewed in January and February 2012, 11 felt that the MLP offered *better* preparation for A level studies than mathematics qualifications previously used at KS4. With one exception, all pilot centres interviewed offering the MLP and single GCSE qualifications thought that the MLP's greater breadth of content made it better preparation for A level study than the new single GCSE.
- There was an increase in the proportion of interactive approaches and investigative tasks used in the small number of case-study pilot centres visited.

Summary of findings

There has been a slight decrease in the number of pilot centres overall, although awarding organisations report that they have recruited further centres. Some (initial) difference in perceptions of the MLP has been observed between pilot centres with different awarding organisations. Case-study pilot centres with one particular awarding organisation have generally reported finding the MLP assessments particularly challenging, with some feeling that this has been reflected in lower than expected student attainment in the examinations. Teachers from two of these case-study centres stated that, as mathematicians, they liked the challenge the MLP offered but that they were concerned about the impact on students' examination results. Pilot centres from another awarding organisation (based on data from the 2011 pilot centre online survey and case studies) were, however, reporting much better than expected examination results and as a result were increasing the number of students they were entering for the MLP.

This potential pattern, tentative though it is, requires further investigation when additional attainment data is available for all students from the first full cycle of the MLP (autumn 2012). This analysis will consider the influence of variables such as student prior attainment and other socio-economic factors such as eligibility for free school meals (FSM). This will help to determine whether the fact that an awarding organisation has a high proportion of pilot centres with students from a particular demographic may influence how challenging the MLP is seen to be, or whether alternative explanations need to be considered. Possible alternative explanations might include a lack of comparability in terms of challenge between assessments, issues with the setting of grade boundaries, or how familiar teachers are with the assessments. Any inconsistency between the approaches taken by awarding organisations may skew the findings of the evaluation, as centre perceptions of the MLP are

often determined by how well students perform (what grades they achieve) in the assessments. All pilot centre data continues to be analysed in relation to a range of background variables, including the awarding organisation used.

Perceptions of the value of the MLP

The main reasons for taking part in the pilot have remained broadly the same since the awarding organisations started to recruit centres for the pilot. The two most frequently cited reasons were the opportunity for students to gain two GCSEs in mathematics, and the opportunity for centres to stretch and challenge their students – but the opportunity for some students to have two chances to gain a grade C at GCSE was also influential in centres' decision to participate. In some of the pilot centres, enthusiasm for the MLP continues to be tempered in part by students' performance in the examinations, which is what determines whether more or fewer students were entered from subsequent cohorts.

Teaching and learning promoted by the MLP

In the follow-up interviews and further case-study visits for this report, centres were still enthusiastic about the breadth of learning the MLP offers. There continue to be conflicting reports, however, on the extent to which the MLP promotes depth of mathematical understanding. Perceptions of depth were often determined by whether centres focused on the specification and/or the assessments in their responses and the extent to which teachers felt confined to teaching only the skills, knowledge and mathematical understanding most likely to be assessed.

It had previously been reported that the effective teaching and assessment of problem solving and functionality were in still relatively early stages of their development.³ This was not considered to be an issue specific to the MLP: a common suggestion from joint-offer centres, but also from awarding organisations and wider stakeholders, was that the issues regarding the teaching of problem solving were also evident for the single GCSE in mathematics. The centres visited in early 2012 were generally positive about the outcomes of introducing investigative-style approaches in their teaching to support the development and consolidation of problem-solving strategies. There is evidence to suggest that some centres are recognising the need, within Methods, for higher-level mathematics for problem solving, for example the use of algebra to solve problems.

Centres reported that teachers were becoming more confident in the use of new approaches in their teaching, although they acknowledged that some teachers were more comfortable with, and still preferred to use, more didactic methods of teaching. Some centres have made progress in finding resources and support with developing their students' problem-solving

³ Issues included:

- Lack of a shared definition by stakeholders of what problem solving and functionality mean in the context of mathematics teaching and learning, and especially in relation to the new assessment objectives.
- Perceived lack of time for staff development and developing students' problem solving skills alongside teaching content – investigative-style teaching approaches were often felt to be too time consuming to be used on a regular basis.
- A lack of resources available.
- Wider stakeholders reported that the development of effective examination questions for the assessment of problem solving would take time.

skills, which many centres had identified as an issue in the first year of the pilot. Centres report that they were benefiting from training and materials provided by the awarding organisations, but some still felt that they would like to get access to MLP-specific, accessible materials and/or more past examination papers.

Student engagement with, and commitment to, mathematics

As before, compared with previous cohorts and with students doing the new single GCSE, in the latest round of fieldwork students are reported as being equally or more engaged with, and committed to, mathematics as a result of taking the MLP qualifications. In some centres, students' engagement and motivation were felt to have increased significantly as the result of new, innovative teaching methods prompted by the introduction of the MLP, such as introducing more mathematics that related to the students' everyday life (Applications), combined with the fact that students had the chance to gain two GCSEs and several opportunities to get their desired grade.

Preparation for progression to A level

Of the 14 pilot centres interviewed in January and February 2012, 11 felt that the MLP offered *better* preparation for A level studies than qualifications previously used at KS4, although a few qualified this, as their students were yet to start A level programmes. Of the three remaining centres, two felt that the MLP did not offer a better preparation than a single GCSE with the OCR level 3 free-standing mathematics qualification (FSMQ) additional mathematics; the third reported that, although the MLP was challenging, they felt that more algebra was required to prepare students for A level.⁴

With one exception, all six pilot centres interviewed in January and February 2012 offering the MLP and single GCSE thought that the MLP's greater breadth of content made it better preparation for A level study than the new single GCSE. The one centre that did not think this felt that the single GCSE with the OCR level 3 FSMQ additional mathematics was better preparation for A level for the higher-attaining students.

Centres' interpretation of the amount of depth required by the specification and/or assessment influences their consideration of how effective the MLP is in preparing students for A level study. Where case-study centres recognised an opportunity to introduce A level materials – such as in estimating areas under a curve in Applications (pre-calculus) and a higher level of algebra in particular⁵ within the content and structure of the MLP – they generally felt that no further 'bridging' in terms of learning was necessarily required.⁶ A few centres suggested that the opportunities to introduce depth should be made explicit within the specifications and recognised in the assessments.

All the case-study centres that felt that additional learning and qualifications were required specifically mentioned the need for higher-level algebra; several mentioned the need to have some introduction to calculus.

⁴ It should be noted that the MLP contains no less algebra than the single GCSE in mathematics.

⁵ Calculus is not in any of the mathematics GCSEs, but some teachers saw opportunities to introduce pre-calculus work, in particular when studying estimating area under a curve (Applications).

⁶ The specification for Methods has a greater emphasis on algebra than the single GCSE mathematics specification.

In summary, two different but related issues are reported here. First, to what extent do the MLP examinations assess the higher-level skills that some teachers recognise in the specifications but not in the assessments? Second, is the material teachers feel is required to prepare students for A level actually more advanced than can be included at GCSE (level 2)? These issues require further investigation in the next phase of fieldwork.

The case-study centres interviewed in January and February 2012 that thought there would be a difference in student cohorts progressing to A level mathematics felt that more students operating at slightly below the top sets were showing an interest in progressing to A level.

Appropriateness of the MLP for a range of student groups

In the observations and follow-up interviews in early 2012 there is further evidence that because of their low levels of literacy, some lower-attaining students are struggling to access scenario-based/contextualised tasks. In addition, the ability to recognise and manage the steps required to think through the task in a logical way was considered a barrier to some students. Overall, however, case-study centres in this round of fieldwork considered the MLP to be broadly appropriate for most student groups *if* there was enough curriculum time to teach the additional content.

Additional Information

Further information about this research can be obtained from
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This research was commissioned before the new UK Government took office on 11 May 2010. As a result the content may not reflect current Government policy and may make reference to the Department for Children, Schools and Families (DCSF) which has now been replaced by the Department for Education (DFE).

The views expressed in this report are the authors' and do not necessarily reflect those of the Department for Education.