INTRODUCTION AND BACKGROUND

The mathematics linked pair (MLP) qualifications are “methods in mathematics” and “applications of mathematics”. These two qualifications together cover the entire Key Stage 4 programme of study and contain some additional content. Neither qualification by itself covers the full programme of study. When the MLP was introduced along with a new single GCSE in 2010, candidates were expected to be entered either for the single GCSE or for both qualifications of the MLP. The MLP had additional wider aims which were:

- to increase students’ commitment to, and engagement with, mathematics;
- to develop greater breadth and depth of subject skills and knowledge in students, by having them engage with additional content which would aid progression to further study; and
- to develop students’ recognition of, and capacity to use, the different methods of enquiry encouraged by having two distinctive GCSEs.

AlphaPlus was commissioned to evaluate the pilot of the MLP. The pilot programme ran from September 2010 until August 2013. During that time, six rounds of fieldwork were carried out and five interim reports were produced. Data was gathered from visits to case-study pilot centres, pilot centre online surveys, and stakeholder telephone interviews and focus groups. The evaluation also included statistical analysis of assessment data provided by awarding organisations participating in the pilot. Data was matched to the national pupil database and data about schools from Ofsted and Edubase. As far as possible, the same case-study centres were visited for each phase of fieldwork in order to offer a qualitative longitudinal study of change brought about by the MLP. Fourteen pilot centres took part in the first round of field research and the sample was refreshed for subsequent rounds where necessary.

KEY FINDINGS

Implementation of MLP qualifications

Centres implemented the MLP in the following ways:

- sequentially, with one GCSE being taught first followed by the second;
- in parallel, with both being taught alongside each other as distinct subjects; or
- In an integrated fashion – i.e. the two GCSEs being taught together.

Initially the integrated model appeared to involve very little change to teaching and learning. Those centres which had opted for this model, however, commonly moved towards a parallel approach as the examinations approached, feeling that this was a more effective way to prepare students for the different types of question they were likely to encounter in the two examinations. Centres taking a sequential approach believed that students would be more likely to achieve a C grade or better only if they had the chance to complete one of the qualifications at the end of Year 10.

Impact on teaching and learning and on participation, attainment and progression

Data from the case studies indicated that the MLP had the greatest impact when the focus was on enriching students’ experience of learning mathematics and increasing mathematic understanding, rather than on increasing GCSE grade performance. For the opportunities afforded by the MLP to be realised, many centres had needed to make significant changes to their teaching and learning styles. Their ability to do so depended primarily on the extent to which they embraced a more student-led, challenging and open approach.

When analysing statistical data, it must be borne in mind that this was a small-scale pilot and care must therefore be taken with interpreting the findings. In 2013, a total of 839,407 students took single GCSE mathematics. This compares with 17,447 candidates who completed both MLP qualifications in either 2012 or 2013. Analysis shows that the attainment of candidates taking the MLP was higher than...
that of single GCSE candidates. Candidates’ attainment on the two MLP qualifications was highly comparable and was higher for both than for the single GCSE. These findings were backed up by the case-study data, where centres largely reported improved grades. The exception was where centres had made minimal changes to their pedagogy and reported that grades were lower than expected on the MLP. Such centres tended to withdraw from the pilot.

The greater emphasis on application of mathematics and use of mathematical problem-solving skills in the MLP was considered advantageous in supporting students in progressing to A level. Two-thirds of the Heads of Maths interviewed in 2012 felt that the MLP rendered the need for bridging qualifications unnecessary; they stated that the MLP was able to fulfil the function of enriching and expanding students’ knowledge in appropriate ways. One third, however, still felt that bridging qualifications were necessary to challenge the most able as the MLP was no more difficult than the single GCSE. For example, bridging qualifications engaged students in more complex algebra as well as calculus and differentiation.

**Value of MLP qualifications over and above what is offered by single GCSE**

The MLP was thought to provide more stretch and challenge than the single GCSE. The three topics most often cited were algebra, pre-calculus and linear programming.

A large majority considered that the MLP encouraged a broader understanding of mathematics than the single GCSE. The four most valued topics were finance, linear programming, Venn diagrams and set theory. These topics were seen not only to be of greatest relevance by students, but also to offer a good preparation for A level. A smaller majority felt that the MLP offered a deeper mathematical understanding than the single GCSE. These respondents cited a breadth of topics which enabled connections to be made. They also highlighted greater opportunities for practising problem-solving skills, more opportunities to apply mathematics and an opportunity to introduce pre-calculus work.

**Appropriateness of MLP for different centres and student cohorts**

Opinion was divided about the suitability of MLP for the majority of student groups. A relatively large number of centres entered the whole cohort for the MLP pilot, but there remained concerns that it may not be suitable for some lower-attaining groups. Low levels of literacy were seen as a barrier to tackling scenario-based contextualised tasks. Some pilot centres were reluctant to run the risk of borderline students failing the pilot qualifications.

**CONCLUSIONS**

Most case-study centres stated a need for more time, both to implement change and to allow for a more interactive approach to teaching and learning which supports skills development. There is a need, in particular, for more emphasis on the different types of problem solving and the different learning which results from them. The MLP pilot has led to some effective collaboration between awarding organisations in an attempt to understand more clearly how to formulate questions which test problem solving. The pilot phase has seen some progress in the teaching of problem solving, but some teachers would like further support. Centres have continued to focus on problem solving in terms of generic skills, where problems are presented with worded contexts which require students to decide to use standard techniques. There has been less focus on problem solving in terms of mathematical ways of thinking.

One of the most positive messages to arise from the pilot was that in some centres there was a strong sense that teachers would not be returning to their old and less engaging pedagogic approaches in the future, even if the MLP were no longer available.

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