



Evaluating Mathematics Pathways

www.nottingham.ac.uk/emp

Interim Report – Executive Summary

Stage 5: January – April 2009

Dr Andrew Noyes, Professor Roger Murphy, Geoff Wake, Dr Pat Drake

1. Executive Summary

This is the Stage 5 report of the Evaluating Mathematics Pathways project covering work completed during January – April 2009. The main focus of this report is GCE and FSMQ qualifications and we synthesise research data from Stage 5 together with findings from previous Stages of the work.

As in earlier Stages of the EMP project, significant policy announcements have recently been made which relate to 14-19 mathematics education, e.g. confirmation of a new GCSE pilot, removal of the functional 'hurdle' for GCSE Mathematics and announcement of a new target of 80 000 A level students by 2014. These are informed by aspects of the Pathways work and will impact on the remaining part of the project. In addition we are now in the middle of a comprehensive consultation on GCE Mathematics qualifications. It is in this ever-changing context that we present this report of our evaluation activity in Stage 5.

Here we summarise five broad conclusions from this Stage 5 evaluation report. More detailed discussion of these points, together with various analyses of the evidence informing them, can be found in the full report.

1. It continues to be difficult to identify an explicit and clearly articulated set of curriculum principles, which underpin the Pathways project, especially in terms of those that could lead a wide range of learners through to appropriate 14-19 courses and qualifications.
2. The FSMQs and Use of Mathematics developments, which build on a recent curriculum innovation, at this point in time offer the only significant additional provision in mathematics by which potentially large numbers of additional post-16 students might be attracted to further engagement in mathematical studies. Our case study evidence suggests that for the substantial cohort of students (~250 000) who obtain a high grade at GCSE and who elect not to continue with any study of mathematics post-16, FSMQs and AS and A level Use of Mathematics have the potential to provide courses of study which appear to be motivating and attractive. At levels 1 and 2 our evidence is that FSMQs and GCSE Use of Mathematics provide a similarly positive and useful alternative course of study which has the potential to re-engage students who have previously been relatively unsuccessful at mathematics.
3. For two reasons the transition to GCE Mathematics or Use of Mathematics from GCSE is likely to remain problematic for some students:
 - (i) GCSE Mathematics does not provide sufficient preparation in algebraic manipulation. Despite efforts to address this in curriculum documents there is much work to be done to shift classroom practices to address this concern.
 - (ii) Structural changes, particularly the two-tier GCSE, the removal of Key Stage 3 Tests and the inclusion of mathematics in the count of 5 A* - C GCSEs performance measure, lead schools to prioritise maximising school performance which may prove detrimental to preparing students for mathematics post-16. This is a particularly problematic in the large number of 11-16 schools who tend to be less concerned about student's future mathematics learning trajectories.
4. FSMQs and Use of Mathematics at all levels offer new approaches to teaching and learning which our case study evidence suggests can be motivating for, and effective in keeping students engaged with, mathematics. These new modes of teaching and learning will require support in terms of materials for both teachers and students and professional development for teachers if the courses are to be implemented in a way that best captures the intentions of their design. This

provides a challenge for the mathematics education community and will require the support of appropriate agencies such as QCA, DCSF, the National Strategies, and NCETM.

5. Assessment design can appear to be too tied to the idiosyncrasies of individual examiners and not necessarily be well matched to the assessment objectives of any particular qualification. These comments are made regarding assessment more widely than that of the pilot alone. There appears to be a need for QCA to work in collaboration with Awarding Bodies and their examiners to ensure that assessment develops to ensure assessment objectives are more carefully addressed with thought being given to how this can support better learner experiences in mathematics.

Together with other issues arising from evidence gathered in schools/colleges and in discussion with various stakeholders we recommend a range of actions. These are contextualised in detail in the report but we simply summarise them here.

Recommendation 1:

There is an ongoing need to make explicit a clear vision for mathematics pathways so that this can inform those closely involved with the pathways developments. At a later stage this needs to be communicated to teachers, senior managers in schools and colleges, parents, HE admissions tutors, employers and so on.

Recommendation 2:

The QCA should ensure that the awarding bodies and examiners understand the important influence that assessment design has on learners' experiences and so work with them to consider how assessment can act as a catalyst for the development of good practice in teaching and learning.

Recommendation 3:

'Public' awareness of the Use of Mathematics qualification needs to be increased, for students, parents/guardians/carers, teachers, HEI admissions tutors and employers. This is particularly important for those applying to university later this year, and although applauding the efforts of AQA to address this information gap, some students assert that tutors are not well informed about Use of Mathematics.

Recommendation 4:

There is a need for the development of case studies that inform mathematics departments of effective ways of implementing and managing the new pathways that can be developed using FSMQs and Use of Mathematics qualifications.

Recommendation 5:

We recommend that high priority be given to supporting teachers of FSMQs and GCSE Use of Mathematics at all levels as they develop and incorporate a range of new pedagogies into their practice, including their use of pre-release materials. This should include development of materials that support teaching and learning as well as professional development, drawing on existing models of good practice, for example the Nuffield Foundation resources.

Recommendation 6:

Given the support for GCSE Use of Mathematics, there is urgent need for consideration to be given as to what should happen post-pilot.

Recommendation 7:

In FSMQs and Use of Mathematics qualifications assessment writers should aim to make more of the realistic contexts framing their questions. This will help to further emphasise the distinctive, applied nature of the course and examples

should draw upon as wide a range of contexts as possible. Efforts should be made to limit pseudo-realism, although this may be necessary at times.

Recommendation 8:

There is need for further consideration of the scope and purpose of computer-based assessment in mathematics. Careful research should be conducted before introducing any form of computer-based assessment in mathematics.

Recommendation 9:

Transition advice needs to be developed for Key Stage 4 teachers which gives models of good practice in supporting students with continued study of mathematics across the transition boundary. It is particularly important that this has impact in 11-16 schools. QCA should consider how this can best be disseminated most widely.

Recommendation 10

The impact of two-tier GCSE should be examined in more depth to establish the impact on various groups of learners and their mathematics learning trajectories.

Recommendation 11

In future evaluations of pilot qualifications, there needs to be sufficient space in the plan to be able to learn from the piloting process before decisions are made and roll out of new qualifications occurs. Timelines for deliverables by evaluators should be carefully dovetailed with other consultation activities and decision timescales in order to make best use of the resources available.

One success criteria for the Pathways projects would be a substantial increase in the number of students studying mathematics post-16. Our evaluation suggests that FSMQs and AS/A2 Use of Mathematics qualifications provide a means of achieving this. However, we need to better understand, and will be exploring in the later phases of our evaluation, how schools/colleges can effectively cope with the increased demands on mathematics teachers and departments more generally.

EMP Management Group

8th May 2009