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# Evaluation of Further Mathematics Support Programme Pilot: Interim Report

Research Summary

Social research

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This is the first of two reports from an evaluation of the Further Mathematics Support Programme (FMSP) pilot for South West Wales.

This first report, compiled from research conducted between September 2012 and September 2013, presents findings from a process evaluation of the pilot and early indications of its impact. The second report is due for publication in the autumn of 2014.

## Key Findings:

### *Process issues*

1. Stakeholders feel that the FMSP pilot has been managed effectively and prudently, with a very hands-on, committed team. An active management committee reports feeling engaged with the project and other stakeholders are highly complementary of the approach taken to date.
2. Schools and colleges engaged with the FMSP. The pilot's stakeholders and management committee were generally very positive about the pilot approach of providing a number of different 'routes' to pupils (and their teachers) to support them achieving a further mathematics qualification. The evidence showed that pupils were able to access the most effective support to match their individual circumstances.

3. Awareness-raising has been underpinned by a thorough programme of publicity, backed by attendance at events and extensive personal contacts from the project team. Mathematics teaching staff in target schools generally had a good awareness of the pilot. Some stakeholders were not sure of the success of the project in engaging parents.
4. Student tuition has been very well received, despite the project having to charge a non-recoverable fee of more than £200 per student to schools. Face to face tuition was highly rated, especially when easily accessible to students, and online support was also appreciated despite some issues of scheduling and student access. There were some concerns about the quality of support through the medium of Welsh and this is an area that should be investigated further.
5. Face-to-face tuition was clearly the preferred method of teaching and learning amongst those interviewed. Teachers spoke warmly of the added value offered by online materials, however; especially past papers and revision exercises, although students were not always aware that resources they were using had originated on the FMSP site.
6. The general FMSP website was felt to be in need of further refreshment, in order to make it more engaging and broaden its appeal beyond those already committed to further mathematics.
7. Enrichment events were a very popular element of the pilot, comprising events targeted at KS4 Pupils and post-16 students, mathematics masterclasses held in university buildings, careers talks in schools and colleges and revisions days in Swansea and Pembrokeshire. The inclusion of careers talks for pupils in years 10 and 11 and masterclasses for year 9 pupils were especially well received for building pupils' interest in studying mathematics and STEM subjects at a higher level. The revisions sessions were also used as refresher courses by staff who had not been involved in teaching further mathematics for some time.
8. Overall, there is no one element of the pilot that has brought

individual success, but it is the integrated approach to support that has been valued by teachers and students alike.

#### *Monitoring and reporting*

9. Currently the quarterly reports compiled by the FMSP team present an overview of school and college registrations to date and the provision of further mathematics by type of delivery setting, summary of recent and planned events, promotional activities and future priorities. However, the information lacks benchmarking or reference to desired outcomes of the pilot.

#### *Value for money*

10. Assessing value for money of a pilot programme can be challenging, given the extent of capacity building and initial programme development entailed, in addition to the delivery of support for further mathematics itself. As discussed above, there is no single clear measure for the number of additional students engaged in further mathematics as a result of the pilot. However, if examination entry data from the

LLWR / WED is used, as the most conservative estimate of outcomes, a total of 165 additional examination entries have occurred against what might have been expected, using 2010 data as a baseline. Against an overall programme cost of £581,485, this represents a cost per examination entry of £3564. However, the pilot has delivered extensive benefits beyond examination entries, in terms of awareness raising and encouragement of students to undertake mathematics and STEM subjects at a higher level, capacity building amongst teachers and setting in place a process which should develop further and bring additional benefits in the coming years.

#### ***Progress against outcomes***

11. The FMSP was set six key outcomes at the start of the pilot. Although there is not yet sufficient time-series data to draw robust, long-term conclusions, the majority of outcomes have been achieved, at least in part. The evidence from the evaluation, as to how

far these have been achieved is set out below.

**Outcome 1: Increased numbers of students in the pilot area studying Further Mathematics at GCE A/AS levels, over the life of the pilot**

12. There has been a clear increase in the number of students undertaking A Level Further Mathematics in the pilot area, although the data is less conclusive in terms of AS level at present. In terms of a counterfactual comparison with Northern Ireland, where figures have not changed, examination entries have clearly increased in the pilot area and also in Wales, but to a lesser extent. Further, there has been an overall increase in the numbers of students studying mathematics, although the indicative rate of increase has been lower than that for further mathematics.
13. Data from FMSP registration data shows a year on year increase in the number of students studying further mathematics at both AS and A Level in the pilot area. Lifelong

Learning Wales Record (LLWR) data and Welsh Examinations Database (WED) data on examination entries shows a sharp rise in the level of A2 Level entries since the beginning of the pilot, increasing four-fold from 21 in 2010 to 105 in 2011 and 87 in 2012. There was also an increase across Wales during that period, where the number of A2 entries more than doubled from 142 in 2010 to 290 in 2012. However, this has not been reflected in AS Level entries in the pilot area to date; there were 50 entries in 2010, falling to 31 in 2011 and 34 in 2012. The reasons for the lack of consistency between the FMSP data and the examinations data sources are not clear and will need to be monitored once further data becomes available. However, it is likely that a contributing factor is that some students do not “cash in” modules taken as AS Levels, but treat them as part of an A Level qualification, which is then recorded in entry and attainment data returns.

14. If the proportion of examination entries in further mathematics is looked at as a proportion of entries in mathematics, there has been a relative increase in the pilot area, against the rest of Wales.

15. Importantly, there are also emerging signs of an increase in further mathematics attainment levels, especially at A Level; both in terms of passes at grades A\*-E and at the highest levels (A\*A) in both the pilot area and the rest of Wales. In terms of passes at the highest levels (A\*A), between 2010 and 2012, attainments in the pilot area increased four-fold (from 11 to 44), and in the rest of Wales by two thirds (from 69 to 115).

16. However, whilst further mathematics entries from both genders have increased in the pilot area, the proportion from females has reduced between 2010 and 2012. By contrast, figures for England showed that the proportionate increase in participation by females has been broadly in line with that for males. Data is available at a Wales level (but not for the pilot

area) for 2013 and shows a partial reversal of the sharp fall in the proportion of female entries in 2012. When data for separate genders are available for the pilot area in 2014, it will be possible to see whether the gender gap is still as wide.

**Outcome 2: More schools and colleges in Wales offering Further Mathematics, either individually, or via consortia;**

17. In 2010, 21 out of 32 school sixth forms and FE colleges in the pilot area offered further mathematics. By February 2013, this number had increased to 26 out of 29 centres in the area<sup>1</sup>.

The number of schools delivering further mathematics in a classroom setting (either timetabled or at lunchtime / after school) rose from 11 in 2010 to 20 by 2013. Over the same period, the number of schools with a single supervised student or up to two unsupervised students fell from five to two.

18. The FMSP secured registrations from all sixth form centres in the

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<sup>1</sup> Mergers of two colleges into one and four sixth forms into two brought about the reduction in total centres from 32 to 29.

pilot area by 2013, along with the majority of 11-16 schools in the region<sup>2</sup>.

**Outcome 3: Increased numbers of mathematics teachers in Wales who are trained to teach further mathematics;**

19. There is no clear means of measuring the “stock” of teachers qualified to teach further mathematics in Wales and so this outcome could not be assessed effectively in the course of the evaluation. Delivery of CPD for teachers was not part of the original pilot programme and online support was introduced in 2013. Discussions with teaching staff during the evaluation suggest that this element should be a focus for continued effort, in order to ensure that Wales has the capacity to meet demand for further mathematics in future. The evaluation found that many mathematics teachers are not confident to teach further mathematics either because they have never received

training in the relevant modules, or because they are out of practice in delivering them.

20. Unlike the programme in England, the pilot FMSP in Wales did not initially include specific resources to address CPD issues; relying instead on the online resources available on the MEI website. The call for teacher CPD within the pilot area led to the start of Live Online Professional Development from October 2013, which has already proved a very popular resource. As a measure of the demand for CPD, approximately 130 teachers had taken part in various events for students and 17 teachers have taken part in various workshops organised to date.

21. In terms of wider levels of qualification to teach mathematics (although not necessarily further mathematics), the number of all secondary teachers trained in mathematics and registered with GTCW increased from 1,204 in 2009 to 1,412 in March 2013, accounting for 9.9 per cent of all

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<sup>2</sup> All of the 11-16 schools and a small number of 11-18 schools that were registered with FMSP did not deliver GCE level further mathematics tuition.

teachers by that date<sup>3</sup> and second only to the number of English teachers (10.2 per cent of the workforce). The data show that 73.8 per cent of those teaching mathematics at secondary level were known to be trained in the subject; the highest for any subject area. For comparison, 30.1 per cent for science teachers were trained in their subject. Further, the number of newly qualified mathematics teachers registered with GTCW grew from 70 in 2009 to 84 in 2013, accounting for 11.8 per cent of the total at that time; the largest proportion of any subject specialism.

**Outcome 4: Overall raised awareness among students and their parents of the importance of studying mathematics at higher levels;**

22. Awareness of the opportunities offered by studying further mathematics is difficult to measure specifically. However, discussions with existing

students and teachers suggest that there is a general understanding of the potential of the subject to support higher level study. The increased take up of further mathematics AS/A Level provision and increased applications for undergraduate further mathematics and STEM courses corroborates this.

23. The evaluation included interviews with and surveys of students and other stakeholders, to test their attitudes towards mathematics and STEM subjects at HE Level. In the online survey of undergraduates, for example, improving career options was one of the main reasons for choosing further mathematics at A Level for almost 40% of respondents. It should be noted, however, that the main motivation for undertaking further mathematics was a personal interest in the subject, rather than an expectation of financial gain, or a university entrance requirement<sup>4</sup>.

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[http://www.gtcw.org.uk/gtcw/images/stories/downloads/Annual%20Statistics%20Digest/Annual\\_Stats\\_13\\_E.pdf](http://www.gtcw.org.uk/gtcw/images/stories/downloads/Annual%20Statistics%20Digest/Annual_Stats_13_E.pdf). No. of teachers registered by GTCW by ITET Subject trained (secondary only).

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<sup>4</sup> For example only 40% of those who said they were motivated by a personal interest in the subject also listed university entry requirements as a motivating factor.

**Outcome 5: Increased numbers of students from Wales applying to study higher education courses in mathematics and related subjects, such as engineering and physics;**

24. Data from HESA shows a clear increase in the number of admissions to mathematics courses from the pilot area over the last three years; from 155 in 2007/8 to 240 in 2011/12. This 55 per cent increase in mathematics course take-up from the pilot area outstripped the growth from Wales as a whole, which was 28%. Increases in applications for STEM subjects were less pronounced and appeared more volatile. When 2012-13 HESA data are available for future years, it will be possible to assess this outcome more fully.
25. However, engagement levels still lie below those of English students and more work needs to be done to narrow the gap. There is a backdrop of low growth in undergraduate numbers from Wales and it was the only UK country to experience a decline in

university applications in 2013, with numbers falling by 0.2 percentage points across all subjects.

**Outcome 6: Improved transition of students from further to higher education courses in mathematics, or from courses which have a significant element of mathematics, thus benefiting the wider economy.**

26. Undergraduate students are clear that transition from A level to degree courses in mathematics, and to a lesser extent STEM subjects is made considerably easier by taking further mathematics at A/ AS Level. Generally, however, this advantage is eroded after the first year of undergraduate study.
27. There was general consensus amongst STEM students and lecturers interviewed during the evaluation that further mathematics at A Level was a clear advantage in the first year at university. In the online survey of undergraduates, the joint most important advantage of studying further mathematics



at AS/A2 Level was that *“It helped with the jump from AS/A level to undergraduate level”*; cited by 27% of respondents, alongside *“It gave me a better understanding of the application of mathematics in general”*.

## **Recommendations**

The following recommendations, based on the lessons learnt through this stage of the evaluation, provide suggestions for developing and sustaining the progress made to date through the pilot.

- (i) The pilot has proved successful in building engagement in further mathematics in the pilot area and the extension to Rhondda Cynon Taf and North West Wales is to be welcomed. This approach should be allowed to consolidate by maintaining support for the extended pilot, whilst considering a change of emphasis within the initial pilot area away from direct support to building sustainability through capacity building amongst teaching staff and sixth form centres. The full breadth of support should be continued where possible, in recognition of the value of an integrated approach to developing awareness, engagement and support for pupils, without prioritising or discontinuing any individual elements.
- (ii) The timescale of the pilot to date is such that there is currently insufficient data to robustly evaluate progress, or to recommend a changes to or extension of the programme in the future. It is therefore recommended that any decision to develop the programme is delayed until findings from the final impact assessment and counterfactual are known.
- (iii) More needs to be done to continue to promote further mathematics to female students and encourage them to take further mathematics at AS/A2 level, as the gender gap in examination entry levels increased during the period up to 2012, despite indications at an all-Wales level of improvements in 2013. Actions could include enrichment events targeted at female students, presenting case studies and using gender-specific materials.

- (iv) Attention needs to be paid to the quality of provision and support in the medium of Welsh, to ensure equality of access and standards to all students in Wales.
- (v) The evaluation has shown the importance at an institutional level of school principals and senior management team members in promoting further mathematics provision – not least because of the financial implications of support. Brokerage work with this group could help to build commitment and embed further mathematics in a sustainable manner.
- (vi) It is imperative that CPD is incorporated more fully into the FMSP in Wales at the earliest possible stage. The clear demand for online resources provides compelling evidence of need. Research with teaching staff has revealed a widespread lack of confidence at best and in many cases staff have not received training in delivering further mathematics at AS/A Level. Future CPD should incorporate a module on use of online resources, to enable more effective use to be made of these. The accreditation of CPD would allow for tracking of take-up and this should be considered.
- (vii) Collaboration and networking across schools should be encouraged to share resources beyond the formal collaboration resulting from the Regional Learning Partnership and 14-19 Partnership arrangements. In particular, any actions to increase levels of face to face tuition at convenient times and locations would be welcomed by practitioners and students alike.
- (viii) The project management and delivery of the pilot have been acknowledged as generally very effective. However, the quality and clarity of progress reporting should be reviewed, to ensure that all partners have a clear understanding of the achievements of the pilot and of where barriers to success occur. The main report sets out suggestions for a reporting framework which clearly presents activities delivered by quarter, progress against outcomes and future plans and

priorities. Securing the suggested data for this report will mean some additional monitoring, most notably monitoring outcomes in schools and colleges supported by the pilot.

(ix) The FMSP Website should be further updated and enhanced, to provide a more effective marketing and engagement tool for the pilot and a stronger identity for support in Wales. More work could be done to alert teachers to the breadth of materials available on the site, possibly including a quick guide to what is available.

(x) Where online activities are provided, their availability requires greater promotion and publicity, and they must 'work' in terms of easy, straightforward connectivity. Timing of sessions also requires more consideration.

(xi) There is currently no textbook for further mathematics modules available to students, which is reported to be a barrier to engagement for some individuals. The development of offline materials of this type

would be a useful development in future.

(xii) Finally, there is a vulnerability in the pilot, in that it has substantially relied on the high level of commitment and support from the programme leader. Plans for any future investment will need to be mindful of the critical nature of this role.

### **Background to the FMSP Wales**

#### 28. The Further Mathematics

Support pilot is an initiative funded by Welsh Government across South West Wales between July 2010 and October 2013, although it has since been expanded to North West Wales and Rhondda Cynon Taf for the period to June 2014.

29. The aims of the FMSP are to support sixth form centres in the pilot area to deliver further mathematics at AS/A Level, through awareness raising, support for schools and colleges, CPD for teachers, enrichment events and online resources.

30. The pilot is intended to increase the number of

students in Wales studying AS/A Level Mathematics and Further Mathematics, grow the number of students from Wales applying to study higher education courses in mathematics and STEM subjects and improve the transition of students from further to higher education courses.

### **The evaluation**

31. The evaluation set out to provide an assessment of both the process and impacts of the pilot programme to date and the extent to which it is meeting its objectives.

32. The evaluation process ran for a 12 month period from September 2012 and included:

- Qualitative fieldwork, including extensive interviews with strategic stakeholders, practitioners, teachers and pupils in sixth form centres, HE admissions tutors and lecturers and first year students;
- Quantitative fieldwork with students and teachers / lecturers

- Extensive desk research and interrogation of existing datasets.

33. Approaches to the counterfactual (i.e. what would have happened in the absence of the pilot) were trialled, using spatial comparisons, (pilot area vs Wales, England and Northern Ireland) and time series (pre-pilot and during pilot). Datasets were employed from:

- Welsh Government for Further Education (FE) and schools (LLWR and WED respectively),
- Higher Education Statistics Agency (HESA, for subjects studied by Welsh domiciled first year undergraduates) and;
- Joint Council for Qualifications (JCQ, for national comparisons of GCE results data).

34. However, the analysis was constrained by a lack of time series data, given that statistics were only available for 2011 and 2012 for examination outcomes in the pilot area. This interim report will be followed

by a final impact evaluation report to be published in autumn 2014. This timescale will allow for an additional year of examination results data (2013), updated FMSP participation data and use of 2012/13 HESA statistics.

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