



EEG

Education Evaluation Group

Evaluation of the Further Mathematics Support Programme

Interim Report on Phase 2

Dr Jeff Searle

October 2010

Contents

1. Introduction and review of Phase 1	Page 3
2. Growth of further mathematics entries	Page 4
3. Second survey; results and analysis	Page 6
4. Analysis of telephone interviews	Page 8
5. CPD: Teaching Further Mathematics Study Day	Page 11
6. Student survey; results	Page 12
7. Stakeholder views of FMSP	Page 13
8. Interim conclusions	Page 17

1. Introduction and review of Phase 1

Phase 1 of the evaluation included the following aspects:

- (i) A measure of awareness in schools and colleges of:
 - courses and qualifications available in further mathematics
 - level 3 mathematics units available for level 3 diplomas
 - support and activities offered by the FMSP to students and teachers
 - CPD opportunities for teachers
- (ii) Establishment of a baseline from which to measure progress of the FMSP towards its aims.
- (iii) A review of the self-evaluation performed by MEI since the commencement of the FMSP.

A final report on Phase 1 of the evaluation was submitted to the DCSF in May 2010.

In Phase 1 of the evaluation it was concluded that the Further Mathematics Support Programme (FMSP) is continuing the positive development of AS level and A level Further Mathematics made during the era of the former Further Mathematics Network (FMN). It was found through the telephone interviews that those establishments where Further Mathematics has been flourishing for many years are pleased that the FMN has continued as the FMSP; teachers recognise the achievements made and the need to maintain the momentum in increasing the number of students participating in Further Mathematics and also enhancing mathematics education in general. It was also found that some establishments are continuing to make use of the various services of the FMSP, and value the various activities that involvement in the FMSP has to offer whilst others are considering making use of some of these services. However, it was also concluded that there is room for further development.

In Phase 2 of the evaluation a second survey of schools and colleges has been carried out on a second sample. Teachers who responded to the survey were again invited to take part in a telephone interview to expand on their views of the FMSP and its services. Although the responses from the survey are still being received and the telephone interviews are ongoing, preliminary result and discussion are given in Sections 3 and 4 of this interim report.

The final report on Phase 2 will include an analysis of the 2010 examination results to assess the progress in take up of Mathematics and Further Mathematics at A level and AS level since the formation of the FMSP in 2009. These figures are not as yet available so Section 2 of this report looks at the growth in numbers taking Further Mathematics in England using figures published by the Joint Council for Qualifications, where they are compared with those for Wales and Northern Ireland.

A major aspect of Phase 2 of the evaluation is to investigate in depth the CPD opportunities offered by the FMSP and teacher's reactions to them. This is happening in October and November of 2010. A visit has already been made to a Teaching Further Mathematics study day, and this is reported on in Section 5.

Another aspect of Phase 2 is to collect the views of various stakeholders who have an explicit interest in the activities of the FMSP. Foremost in these stakeholders are the students themselves, and the results of a survey of students who studied Further Mathematics using tuition received through the FMSP are given and discussed in Section 6. The views of some prominent stakeholders in mathematics and STEM education have also been sought; these are currently being received and all those received so far are given in Section 7.

Section 8 draws together some interim conclusions.

2. Growth of entries in Further Mathematics 2004 – 2010

The figures used in Table 1 to show the growth in the number of candidates entering for a qualification in Further Mathematics are those of the Joint Council for Qualifications which are published soon after the examinations have taken place in June. They are not as authoritative as the figures released later by the Department for Education, but are suitable for comparative purposes, both for year on year growth, and for comparison with Wales and the Northern Ireland, whose figures are also published by the Joint Council for Qualifications.

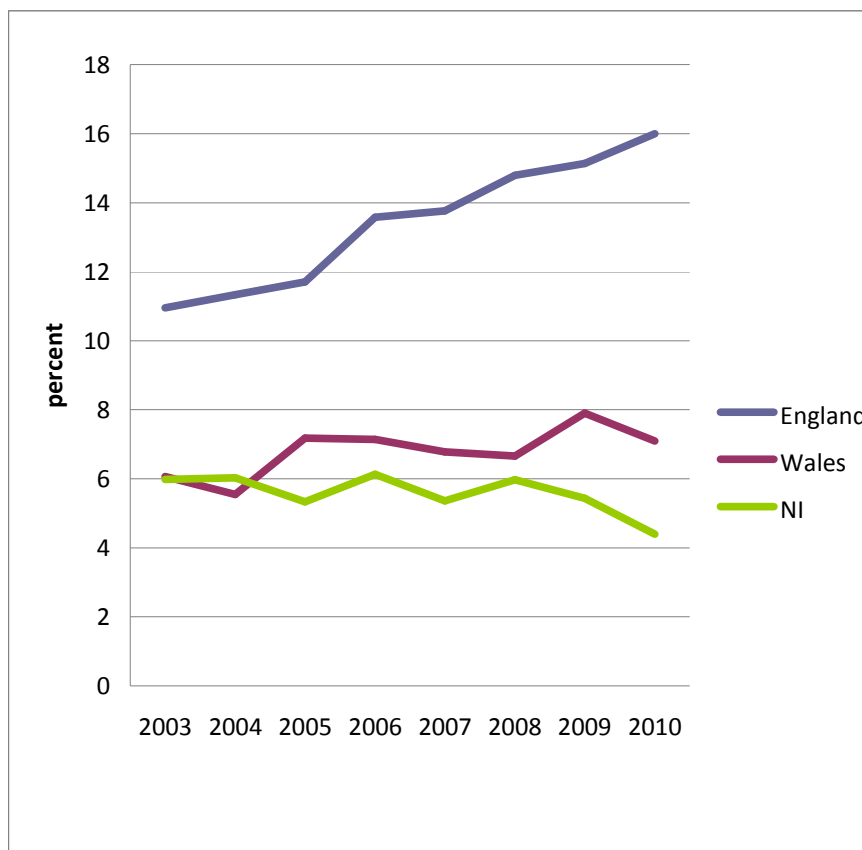
Although the numbers of candidates entering Further Mathematics are much higher in England compared to Wales and Northern Ireland, the percentage change in England over the 7-year period 2004 to 2010 is much higher than in the other two countries. In England it is seen that growth in entries in both A level and AS level was sustained from 2009 into 2010 but this was only mirrored by the AS level in Wales, otherwise numbers in the other two countries have decreased. Given that the FMSP operates only in England, there is evidence here of the FMSP having a significant impact and being influential in the growth in entries.

Table 1 Number of candidates entering A level and AS level Further Mathematics

		2004	2007	2004-2007 percent change	2009	2010	2004-2010 percent change	2009-2010 percent change
England								
	A level	5443	7551	39%	10073	11312	108%	12%
	AS	3761	7124	89%	12710	14414	283%	13%
Wales								
	A level	138	186	35%	250	240	-4.0%	-4%
	AS	94	145	54%	245	275	12.2%	12%
Northern Ireland								
	A level	139	135	-3%	150	130	-13.3%	-13%
	AS	125	157	26%	209	195	-6.7%	-7%

Another comparison can be made using the proportion of candidates who have taken A level Mathematics and Further Mathematics in the three countries. This is shown graphically in Figure 1.

Figure 1 A level Further Mathematics entries as a percentage of A level Mathematics entries



It is seen in Figure 1 that the number of candidates taking both A level Mathematics and A level Further Mathematics has been growing steadily in England, but this is not the case in Wales and Northern Ireland. The percentage in Wales has been fairly consistent, whereas in Northern Ireland it

has a downward trend. This is further evidence of the positive impact of the activities of the FMSP in the take up of Further Mathematics in England.

DfE data show that between 2005 and 2009 the proportion of state funded schools in England with students taking A level Mathematics that also had students taking A level Further Mathematics rose from 40% to 60%. This indicates that while there has been a considerable increase in access to Further Mathematics in the state sector in England, there is still much to be done. DfE data also show that in 2009 13% of A level Mathematics students educated in the state sector also took A level Further Mathematics. In the independent sector the figure was 21%. This also indicates that there is still work to be done to improve access to Further Mathematics in the state sector.

3. Second survey; results and analysis

In Phase 1 of the evaluation 2011 schools and colleges in England were identified as state funded establishments that had at least one student entered for AS level or A level Mathematics in the year 2007-08. A sample of 501 schools and colleges was drawn from these establishments stratified by the number of them which were located in each of the nine regions of England. This sample was surveyed in December 2009 and January 2010, with 114 responses. A second sample of 501 establishments was similarly surveyed in October 2010, with (to date) 115 responses. The survey questionnaires were nearly identical for both surveys, the only changes being in questions 1 and 6. In question 1, respondents were asked simply whether they were aware of the FMSP rather than had they read its introductory leaflet, and in question 6 the term “network” was replaced by “consortium” to clarify what the question was asking.

Responses from the first survey are reproduced in Tables 2(i) and 2(ii) for comparison with the second survey, which are shown in Tables 3(i) and 3(ii).

Table 2(i) Results of first survey

	Q1	Q2a	Q2b	Q3	Q4	Q5	Q6
No response	4	2	7	2	10	107	4
Yes	77	105	95	13	90	0	41
No	33	7	12	99	14	7	69
	114	114	114	114	114	114	114

Table 3(i) Results of second survey

	Q1	Q2a	Q2b	Q3	Q4	Q5	Q6
No response	0	1	3	4	5	110	0
Yes	109	106	102	11	95	0	27
No	6	8	10	100	15	5	88
	115	115	115	115	115	115	115

Table 2(ii) Results of first survey

	Q5a	Q5b	Q5c	Q5d	Q5e	Q5f	Q5g	Q5h
No response	61	44	99	32	96	32	27	27
Use	18	27		22		43	39	29
Would consider	35	43	15	60	18	39	48	58
	114	114	114	114	114	114	114	114

Table 3(ii) Results of second survey

	Q5a	Q5b	Q5c	Q5d	Q5e	Q5f	Q5g	Q5h
No response	75	59	96	40	95	29	29	28
Use	14	21	1	24	2	45	47	32
Would consider	26	35	18	51	18	41	39	55
	115	115	115	115	115	115	115	115

In comparing Tables 2(i) and 3(i) it is seen that the results are very similar, although awareness of the FMSP in the more recent survey, Q1, is seen to be 95%, compared to 70% who had seen the leaflet in the first survey. The number of respondents, Q2, saying they offer both AS level and A level Further Mathematics was about 90% on both surveys (note that DfE data show that 60% of state funded schools and colleges in England actually had students taking A level Further Mathematics in 2009), whereas again in Q3 it is seen that very few establishments offer the level 3 Diploma in Engineering. It is seen in both surveys that not all establishments who offer Further Mathematics are registered with the FMSP but the large majority are, this being 83% in the second survey compared to 79% in the first survey. The responses to Q5 are very similar, indicating that most respondents are at least considering using one or more of the services that the FMSP offers. There is little basis for comparing Q6 due to the changed wording, but it is seen in the second survey that 27 of the respondents consider their establishment to be working with at least one other school or college to deliver KS5 mathematics.

Questions 5a through to 5h refer to services offered by the FMSP and respondents had the option of no response, or indicating they currently use the service or that they would consider using the service.

The number of establishments using tuition, Q5a, offered by the FMSP was similar in both surveys, at about 14%. In the second survey somewhat fewer respondents indicated they were considering using the tuition service, but combining the two surveys indicates about 25% of establishments are considering this. Q5b indicates relatively fewer respondents using or considering advice from the FMSP, but it is still about 50% of the respondents. Both surveys indicate, Q5c, there is little interest at present in the level 3 Diploma in Engineering, although about 14% of all the respondents said they are considering seeking advice about the mathematics involved through the FMSP. For professional development, the second survey indicated a similar number to the first currently using CPD offered by the FMSP, with a slightly fewer thinking about it, although in combining the samples about 70% of the respondents would at least consider taking up this service. The numbers interested in CPD for the diploma, Q5e, were similar to those who might seek advice about teaching the mathematics involved. The

number of respondents who indicated they use, or would consider using the revision events provided by the FMSP were similar in both surveys; for the second survey the figures for mathematics were 39% and 34% and for Further Mathematics 41% and 34% respectively. The number of respondents indicating that their establishment uses or would consider using enrichment events provided by the FMSP for any year group were similar in both surveys, with about 27% using this service with about another 50% considering using it.

4. Analysis of telephone interviews

To date 30 of the proposed 50 telephone interviews from the survey (Section 3) have been conducted. These were predominantly with 11-18 schools but included four post 16 colleges. The schools were mostly mixed schools but included some single sex, and mostly comprehensive schools but including some grammar schools and academies. The number of students taking Further Mathematics in the academic year 2010-11 in these schools varied from two students taking the AS level in one school to substantial numbers in excess of 20 taking the full A level in some of the grammar schools and colleges.

The interviews thus far have covered a range of schools and colleges geographically spread across England. The time tabling arrangements for the students taking Further Mathematics vary considerably, but in many cases Further Mathematics does get a little less than full timetable allocation when compared to mainstream A level Mathematics. In some schools, where the numbers are very small there is no actual allocated timetable time, and support is offered in teachers' and pupils' own time, often supporting the tuition that is available to the students through the FMSP.

Despite the variation in the types of establishment and the number of students they have taking Further Mathematics, there was a high degree of consistency in the replies to the interview questions. Many noted that numbers taking main stream AS level and A level Mathematics have increased in recent years and this had been mirrored by an increased take up in Further Mathematics. This was largely put down to students having positive experiences with GCSE, where they were doing well and staff encouraged them to think about taking mathematics post 16. However, this was qualified in some schools by teachers pointing out that some students who think they are doing well at GCSE do struggle at AS and do not continue with A2 Mathematics; some schools are thinking that a grade B at GCSE is now not sufficient to continue with post 16 advanced Mathematics. However, many establishments pointed to their good results in both Mathematics and Further Mathematics as an incentive for year 11 students to be encouraged to take their mathematics further.

4.1 *Engagement with the FMSP*

All these 30 establishments, bar one, were registered with the FMSP, although the amount of contact with the local coordinator did vary from just receiving emails notifying local FMSP events to frequent and direct contact. Some teachers did note they would like more opportunity for direct contact and to discuss their provision of Further Mathematics with the local coordinator but time was a preventive barrier. Most though were grateful for the support from the local coordinator; for some just knowing it was available should they need it, was considered as beneficial. Some teachers explained how their former contact with the local Centre Manager from the Further Mathematics Network had been instrumental in getting Further Mathematics established in their school and they had built up their confidence to now offer Further Mathematics without so much support, but were pleased it was still available if they needed advice or some help with tuition. Some noted where they had one or two particularly able students who wanted to take the “AEA Award” in Mathematics or the “STEP” papers, that they were very grateful for the available online support for those students.

4.2 *Professional development*

Most of the teachers interviewed noted that there was sufficient expertise in their departments to teach all the Further Mathematics modules that they wished to, even if in some cases this expertise resided with one or two teachers. Some teachers, particularly where student numbers were relatively large, noted how fortunate they were that their department had a large number of well qualified mathematicians who could teach a range of the modules. Many teachers supported each other within a department in their teaching of Further Mathematics, but there was also a general awareness of the need to encourage newly qualified staff into teaching further mathematics and that well qualified staff might well, sooner or later, leave the department. Thus there was a need for CPD opportunities. Some teachers noted the need for new staff to have CPD input on some Further Mathematics topics whereas more experienced staff would find refresher courses helpful. Many teachers noted the difference between knowing the mathematical content of some of the topics as opposed to how best to teach it. This latter point illustrates one of the main differences between CPD offered as a face-to-face event and CPD offered via online computer based sessions using specialist software. It was noted that face-to-face events not only focus teachers minds on the event itself but gives them opportunity for interactive discussion and sharing of ideas on the teaching of topics; how to make it more interesting and stimulating for the students was brought up frequently. Online provision was thought to offer less opportunity for interaction and tended to be more instructional and topic based, although some of the online provision was described as excellent. Many teachers however did note the difficulties of getting release to go to face-to-face events due to cover and other cost implications, and the attitude of senior management to this varied considerably. Against this the flexibility offered by the online provision was noted, particularly there being no need to travel and no need for cover, thus reducing costs considerably. However, there are difficulties associated with being available for a “live” online event, with opinion split over a best time and whether daytime was preferable to post 4:00 pm provision. Some teachers thought a recording of an event would be

better than no event. The topics that teachers would like to see covered in CPD events varied considerably, some wanting pure mathematics whilst others wanted applications. There would appear to be a demand for CPD provision for the less popular modules, such as FP2 and FP3 and M3 M4 and S3 S4 and also in decision mathematics.

4.3 *Revision Events*

This same contrast between online provision and face-to-face provision is seen in the FMSP provision of revision events for students. Some schools and colleges put on their own revision events as examination time approaches, nevertheless most bring the online opportunities to their students' attention but leave the decision whether to participate up to the students. Of those who had students who had taken up some online provision, the feedback varied from excellent to not of much use, this varying with both the topic and the presenter, though online feedback from students was overwhelmingly positive. Students who had attended face-to-face events generally found them to be very useful, appreciated input and fresh perspectives from a "new teacher" and usually came away with a summative set of resources that they found very helpful. It was said that teachers often accompany students to the face-to-face events and get a lot out of attending themselves, this being another important aspect of CPD provision. It was, however, commented that revision events tended to be examination board specific and it needed to be made clear which board, and which modules were being covered. Some teachers suggested revision events could have greater flexibility with some topics that were common to all boards being covered in one part of the day whilst other more board specific topics were covered in another part of the day.

4.4 *Enrichment*

On enrichment, most of the schools engage their students in some sort of enrichment activities across all the year groups. The most common of these is the UKMT Maths Challenge and most schools enter pupils at the junior, intermediate and senior levels. These are often associated within school or inter local schools competitions. The FMSP involvement in arranging the local heats of the national senior competition was noted and appreciated. Many schools have a maths club of some sort, and have an event which focuses around maths, such as a specialism day, or on maths in use in the work place. Many teachers talked about inspiring and enthusing younger pupils and many had taken pupils to events where they thought this had happened, but this was not necessarily always the case. Some teachers asked that FMSP be doing more to support enrichment in mathematics pre 16 and help them get away from text book based provision. Similarly others thought that there could be time at the end of year 12 for some extra curriculum input, possibly through a university, so that A level students could experience a new area of mathematics in a higher education environment.

4.5 *Resources*

Many in particular said how much they valued the MEI resources which are made available to them and their students through their registration with the FMSP. Words like "brilliant" and "fantastic" were used to describe the

resources, some saying how they helped them as teachers to teach Further Mathematics well as well as encouraging independent study by their students. Some hoped the resources could be extended to providing a library of text books and past papers for the modules where such resources are not readily available or only required in small numbers.

4.6 *Interim conclusion from the telephone surveys*

Generally teachers are very pleased with the FMSP and what it is doing. Many talked of the high quality support available and they wanted more of it.

5. CPD: Teaching Further Mathematics (TFM) Study Day

The Teaching Further Mathematics (TFM) course offered by MEI provides an extensive course of professional development for teachers of A level Mathematics who are now teaching Further Mathematics or wish to teach it at some point in the near future. The course covers material from all Further Mathematics specifications with emphasis on expanding the participants' mathematical horizons and giving them a deeper understanding of the links within mathematics. The course takes over a year to complete, and can contribute to a higher degree. An evaluator attended the first session of the course for 2010-11 to observe the proceedings and to discuss with participants their reasons for taking this course and their expectations.

The first "Study Day" associated with the current TFM course took place at Warwick University in October. It was attended by 21 of the current 27 participants signed up to the course. The number of participants is fairly evenly balanced by gender (11 male, 15 female), with age ranging from 20s to 40s. Some of these participants had come relatively late into teaching having had various mathematics related careers before entering the teaching profession. They were finding the course demanding, but were managing and were grateful for all the support that was available to them. Most were currently teaching, or had taught, at least one Further Mathematics module.

The study day was led by the Professional Development Leader and the Student Support Leader from the FMSP. The programme for the day was intensive, and started with a presentation from the Professional Development Leader who put the TFM course in the context of the broader aims of the FMSP, and illustrated this with figures on the growth in number of students taking Further Mathematics in recent years. She then "broke the ice" with a warm up session inviting the participants to tackle and share some problems in complex numbers, which they had come prepared to do. This appeared to be very successful with participants sharing and discussing their results. This was followed by showing the participants where, and how they can get further support for the TFM course and outlining the course requirements and where various web based support resources are located. There is clearly considerable support available to these participants, not least by direct email to the Professional Development Leader.

The second and third sessions of the Study Day were taken by the Student Support Leader. He gave a presentation about the further mathematics topic of matrices, giving the participants lots of ideas to follow up with their students particularly in practical applications which students might well have encountered, such as how does the internet search engine *Google* work? The Student Support Leader also took the third session focussing on proof again giving the participants lots of ideas on how to approach the teaching of topics that students often find difficult. In the last session of the Study Day, participants worked together in small groups on problems from Further Mathematics, given to them in formats that they could use with their own students if they so wished. This was very interactive and discursive and all participants seemed positively engaged with what they were doing. They certainly had resources to take away with them including text books for the remainder of their TFM course.

The evaluator asked some of the participants what they had got out of attending the Study Day. To meet with other participants on the course was welcomed, and the presentations on the further mathematics topics, both the content and ideas for teaching them, were much appreciated.

6. Student survey; results and analysis

After the end of the courses in A level and AS level Further Mathematics in the summer of 2010, students who had received their tuition through the FMSP were invited to take part in an online survey of their experience of the FMSP. There were 150 responses to the survey.

Table 4 shows how these 150 students received their tuition. Table 5 shows how they rated both the standard of the tuition itself and also the standard of the online resources made available to them by the FMSP to support their study.

Table 4 How FMSP students received tuition.

	Number of students	Percentage
Face to face lessons	102	68
Regular online sessions	25	17
Both	23	15

Table 5 Student ratings of the tuition and the resources provided to support their study

	Tuition		Resources	
	Number	Percentage	Number	Percentage
Excellent	86	58	68	45
Good	50	34	57	38
Satisfactory	10	7	11	7
Poor	3	2	0	0
Did not use	-	-	14	9

It is seen in Table 4 that the vast majority of students had their tuition provided by a FMSP tutor in face-to-face lessons. It is also seen that over 90% of the students rated their tuition as either excellent or good which speaks for the quality of the tutors provided by the FMSP both for the face-to-face lessons and the online support. Similarly over 80% of the students thought the online resources provided were at least good, with relatively few saying they made no use of them.

The students were asked about their higher education intentions, with 148 indicating they intended to go to university, with 48 saying they intended to read mathematics. Of the remainder, only 12 indicated their intention to study in a non-STEM related area, with many indicating they would continue to study mathematics together with a science or type of engineering. These opportunities are unlikely to have been available to these students without the support of the FMSP, which may have influenced their decisions and helped them achieve the A level grades needed for entry.

The students were invited to make any comment they wished about the tuition they had received and 85 did so, with about half of these saying something very positive about it. The main criticism was that they would have liked more time for face-to-face contact and online support.

7. Stakeholder views of FMSP

The views have been sought of a range of prominent stakeholders within the mathematics and wider STEM communities on the activities of the FMSP. All of the responses received to date are given below.

Professor John D Barrow FRS
Professor of Mathematical Sciences
Director, Millennium Mathematics Project
Cambridge University

The Further Maths Support programme has been an outstandingly successful and cost effective programme. With a minimum of administrative overhead it has produced a big increase in the number of students studying Further Maths at AS and A level. This has improved their performance in other maths A levels and prepared them to enter university courses in maths, physics, engineering and other sciences with enhanced confidence in their problem solving abilities and their knowledge of mathematics. It prepares science students as well as mathematicians for the next step in their careers. It has also encouraged schools to make their own teaching provision for the subject and we have seen successful schools become new centres of teaching provision for others in their region. The Programme has pioneered new distance learning methods. I hope the Programme will not only continue but be enlarged and extended in range and scope. It provides university-bound students with the extra mathematical knowledge and expertise that their

future lecturers and tutors want them to possess. It is a very wise investment.

Professor Christopher Budd
Professor of Applied Mathematics (and first year lecturer)
University of Bath

One of the biggest problems faced by university maths departments is dealing with the transition between school and university level mathematics. The Further Maths Support Programme has made a huge difference to this. As a result of their good work we can now expect far more students from all school backgrounds to have done further maths than before which means that they are much better prepared for our courses. Furthermore, the online resources that the FMSP has provided have proved invaluable in not only bringing up to speed those students who have not done further maths, but in acting as revision material for those that have. This makes our job much easier, and means that the students can get more out of their university degree. I can also say that the FMSP has given us a much greater opportunity to interact with schools both through the various outreach events that they organise and also in their willingness to act as a link between school students and undergraduates. Long may the FMSP continue to grow and thrive.

Professor Peter J Giblin
Department of Mathematical Sciences
The University of Liverpool

The Further Maths Centre in Liverpool started in 2006. We were exceptionally lucky in being able to recruit a young and enthusiastic teacher to be the Manager, someone who was highly qualified but simply looking for a part-time post. He has stayed with us since then, now being one of two North-West coordinators of the FSMP. He has brought FM students to the University as well as, of course, organizing groups in other locations. This has brought a new kind of expertise into the Mathematical Sciences Department, attracted excellent students to take mathematically related degree courses, including many in Liverpool University itself, and raised the profile of FM and of the University in the region. Revision classes not only in FM but in core A level, and, recently, a Continuing Professional Development programme in the teaching of FM, aimed at local teachers, have all been developed and expanded during the past few years. Thus the FMSP is truly fulfilling its mission of increasing participation in FM, of giving teachers the skills to take it on themselves, and, as a by-product, of raising the profile of the University among schools in the North-West.

Professor Matthew Harrison
Director, education
The Royal Academy of Engineering

Engineering is under-pinned by mathematics. For many branches of engineering (electrical and electronic, vibration and dynamics, aerodynamics, systems and control for example) the mathematical topics and concepts required are found in Further Mathematics at A Level and not in the more general Mathematics A Level. The success of the FMSP in increasing participation in these topics is of significant value to the engineering profession because it is helping prepare more young people for their engineering training. This is augmented by the recent support offered by the FMSP to those teaching the Advanced Diploma in Engineering.

One unique feature of the FMSP is that its impact is readily evaluated. Further Maths was in terminal decline until the FMSP (and its predecessor FMN) arrived. It remains in decline in the territories where the FMSP doesn't work. But in England it is growing strongly. The FMSP is the engine for that growth and the engineering profession is an important beneficiary of that success.

Dr Stephen Hibberd
Associate Professor
School of mathematical Sciences
University of Nottingham

FMSP within the East Midlands is helping to maintain the momentum of increasing awareness of the benefits for advanced study in GCE mathematics, particularly relevant to the study of many STEM subjects at HE. Initiatives to promote and enable the study of Further Mathematics modules to teachers and students in schools and colleges are managed and enabled through an effective expert network. Local activities engage and enthuse students that mathematics is a living and evolving subject, each day being applied to the description and understanding of the physical, biological, commercial, digital and social world around us.

Professor Peter Main
Director, Education and Science
Institute of Physics

It is rare in education to be able to pin a change in behaviour to a particular initiative or intervention. However, there is no doubt that the FMSP, and its predecessor, has been largely instrumental in the dramatic and very welcome growth in the numbers of students taking AS and A levels in Further Mathematics. This growth has been a wholly positive feature of the STEM environment. Although Further Maths is unlikely to become an entrance requirement for HE courses in physics and engineering in the foreseeable future, it is undoubtedly an excellent qualification for entrants to such courses, both in terms of knowledge and, particularly, the extra

facility in mathematical manipulations. The Programme is to be congratulated on making such a large and positive contribution to STEM education.”

Dr Carol Robinson
Director Mathematics Education Centre
Loughborough University

The FMSP in the east Midlands is organised jointly between Nottingham and Loughborough Universities. The two area coordinators are outstanding in their roles and the services they offer across the region reflect their commitment, hard work and dedication.

The FMSP has had a tremendous impact across the region. The enhancement events motivate young people to take an interest in Mathematics and to encourage them to study the subject at A level and beyond. These include Maths at Work conferences, I am an engineer-this is what I do events, Packaging challenges, etc.

CPD for teachers features strongly in the Area Coordinators’ work and they are currently preparing CPD events to support teachers in the teaching of Further Mathematics.

Of course overriding all the above is the provision and support for Further Mathematics A level. Local schools have benefited greatly from the provision of twilight classes at Loughborough University. Some of these schools have now taken the teaching of Further Mathematics in house.

Senior managers at Loughborough University are very supportive of the outreach work which is undertaken by our area coordinator as part of the FMSP.

Professor Colin Sparrow
Head of Department, Mathematics,
University of Warwick

It is a privilege to work with the Further Maths Support Programme. The programme is extremely effective in raising the profile of mathematics in schools and colleges, and in enthusing, encouraging and supporting students who wish to take Further Mathematics (and beyond).

Feedback informs us that all the activities organised through the Further Mathematics Support Programme are very well received by both students and schools. This includes the support classes and revision days, the CPD training offered to teachers, the on-line resources, innovative ways of teaching, and the enrichment and other events.

Many UK HEIs provide very strong Mathematics degree programmes

that either require or recommend Further Mathematics as a prerequisite. The department in Warwick prides itself on delivering a high quality education to its student body, regardless of the background of individual students. The work of the Programme is essential to ensure that we maintain this quality, and that we can attract suitably qualified students from all schools and colleges, including those who may not themselves be able to provide all the mathematical support required.

Professor Charles Taylor
Department of Statistics
University of Leeds

It has clearly made a difference to the number of pupils studying Further Maths at AS and A level. This is clear by considering the take-up of Further Maths in England, Wales and N Ireland. The number of schools offering further maths has increased steadily over the last five years, which is consistent with the aims of the programme, which seeks to support both teachers and pupils across the country.

8. Interim Conclusions

There is wide spread awareness across England of the FMSP and the services it offers to teachers and students.

The services that the FMSP offers are taken up to various degrees depending on particular schools and colleges circumstances, but these services are generally valued by those who use them, and by those who have used them in the past. The achievements of the FMSP are generally recognised as positive and productive by mathematics teachers and stakeholders in mathematics and STEM education in general.

Teachers clearly value the professional development opportunities that the FMSP offers, enabling them to learn or refresh their knowledge of topics within Further Mathematics, whilst sharing and discussing ideas with colleagues from other establishments on how best to introduce and teach such topics.

Teachers and students are very positive about the resources made available to them through being registered with the FMSP, both in terms of topic based materials and also online help and advice with teaching and learning those topics. Students who received their tuition through the FMSP are generally very satisfied with the experience and grateful for the opportunities that it offered them. It is notable that most of the students surveyed intended to enter higher education either to read for a degree in mathematics or in a STEM related area.

The stakeholders who have been contacted and responded to date are also very positive about the achievements and activities of the FMSP. The

stakeholders from higher education in particular have emphasised how it is helping to prepare students for the high mathematical demands not just of a degree in mathematics but also in STEM related areas.

The FMSP continues to build upon its previous achievements and the number of students taking Further Mathematics at AS level and A level has continued to increase in England. It is problematical to say that this increase is due solely to the activities of the FMSP, but the comparison with the change in student numbers in Wales and Northern Ireland over the last six years, is strong evidence that the influence of firstly the Further Mathematics Network and more recently the FMSP has had a substantial impact. It seems very unlikely that the substantial growth in student numbers studying Further Mathematics in England would have occurred without the intervention of the FMN and the FMSP. More so, it seems unlikely that the substantial growth in numbers and the associated opportunities for professional development of teachers and support for students will be sustained if the activities of the FMSP were to be curtailed.