Background

Queen Mary is part of the federation of colleges that make up the University of London. The School of Mathematical Sciences is one of the largest mathematics departments in the UK. It is based on the Mile End campus, about two miles east of central London. I’ve worked there since August 2007. Until April 2009 I worked as a project officer for the East London region of the national more maths grads project funded by HEFCE. I now work as the School’s Executive Officer for Teaching and Research.

In this article I will describe some of the activities we have carried out at Queen Mary and how effective they have been in the East London context.

Introduction

The main goals of the more maths grads project were to encourage more students to take up degree courses in mathematical sciences and to increase the numbers participating from traditionally under-represented groups. In practice we concentrated our efforts on schools and colleges with high proportions of students who come from lower socio-economic backgrounds or who are of Bangladeshi, Pakistani, Black Caribbean or Black African ethnicity.

The project ran since the summer of 2007 and continued work and dissemination until January 2010. It was managed by the University of Birmingham with three pilot project regions of East London, West Midlands and Yorkshire and the Humber. The project officers in these regions were based respectively at Queen Mary, Coventry University and the University of Leeds. The regions worked closely together to ensure that good ideas were tried in several different settings. In London our target boroughs were Hackney, Newham, Tower Hamlets and Barking and Dagenham, all of which contain substantial areas of social deprivation.

At Queen Mary the more maths grads team consisted of myself and Zia Rahman as project officers and Jenny Allam as administrative assistant. We were supported by Professor David Arrowsmith as Head of the School of Mathematical Sciences and Professor Peter McOwan of the Department of Computer Science. My previous position had been as a postdoctoral researcher in Cambridge, while Zia had been head of mathematics at a large sixth form college in Hackney. In May 2009 my role was taken over by Matt Parker, another mathematics teacher and outreach specialist. Peter McOwan carries out a great deal of outreach work in schools and colleges, especially with his Sodarace and CS4FN projects. We were able to pull our different experiences together and balance supporting existing work in East London with some new ventures.
### Changing students’ perceptions of mathematics

School pupils think of mathematics as hard, boring and not useful for their careers – at least according to the Smith report of 2004, “Making Mathematics Count”. The National Centre for Excellence in the Teaching of Mathematics – website [https://www.ncetm.org.uk](https://www.ncetm.org.uk) – is working with teachers to improve mathematics teaching and tackle perceptions of maths as hard and boring. We decided to focus more strongly on motivation: where does the maths that people encounter become of use to society? Therefore the strategy we adopted in East London in our work with school pupils from Year 7 upwards was to encourage them to think of mathematics as useful and to associate mathematics with a wide variety of careers.

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Between October 2007 and April 2009 the Queen Mary more maths grads team had run over sixty workshops based in schools and colleges, distributed posters which highlight applications of mathematics, encouraged mentoring schemes and produced a maths and careers DVD with associated GCSE / Level 2 mathematics resources. Other widening participation and maths outreach activities have been in place at Queen Mary and in East London for several years. In the course of our project activities we worked with local personnel from Aimhigher, the Further Mathematics Network, NCETM, Setpoint and Queen Mary’s own Widening Participation and Education Liaison departments. We have worked in collaboration with the permanent mathematics and physics outreach officer for Queen Mary, Laura Thomas.

Once the more maths grads project has run its course I hope that Queen Mary will continue its links with local schools and colleges, particularly through student ambassador work. This will provide benefit to academics and university students as well as to teachers, school pupils and college students.

### A. Student ambassador activity

Queen Mary already ran a great deal of ambassador activity when we started the work of the more maths grads project there. We decided to support this activity as best we could, and offer some additional opportunities for students who wished to get involved. One of these was to support the work of the Enriching Mathematics project described below. We also encouraged the department to set up a new elective module for third-year undergraduates based on the successful Undergraduate Ambassadors Scheme.

We planned the module during 2007/08 and the School ran it for the first time in 2008/09 with support from the Director of Undergraduate Studies, Dr Francis Wright, and our team. The academic coordinator for the module was Dr Craig Agnor of the Astronomy Unit in the School of Mathematical Sciences. Nine undergraduates were placed in five secondary schools as a result of this module, and several said to us that it had really helped them obtain PGCE places or in interviews. Three of the schools were in Newham, one in Barking and Dagenham, and one in Tower Hamlets. We were even able to place one student at her own old school, which worked very well.

All the students reported that they noticed improvements in technology since they attended school: for example, interactive whiteboards are now standard in most London schools. The students experienced a wide variety of pupil behaviour and teaching strategies, much of which was reflected upon during their assessed presentations. The module was supported by professionals from Queen Mary and from the Further Mathematics Network who delivered workshops with the students during the module.

About thirty UK mathematics departments now run a module based on this scheme. Dr Agnor was helped by the advice of mathematics colleagues at Imperial College London on setting up and running this module. Our contacts in local schools were also useful in arranging placements for the students. We discovered that many departments in London schools already have experience of mentoring students on ambassador schemes such as this or the Student Associates Scheme funded by the Training and Development Agency for Schools. However, school mathematics departments are busy places and it does take some perseverance to follow up the expressions of interest and get written confirmation. Dr Agnor looks forward to developing the module further in future years.

I sent out a short questionnaire to students on the module and received responses from four of the students as below. It’s clear that for these students it has been a very positive experience and from talking to the students as a group I think that these responses are typical of all the students on the module.

1. Would you recommend this module to other students at Queen Mary?

“Yes definitely, this module has been the most enjoyable compared to all my other university modules. From this experience I have found that my passion not only lies in learning maths but more so in teaching maths.”

“I would definitely recommend this module to other students, because not only does it give you a real insight into how mathematics is taught in schools but also it helps to develop your communication, leadership and teamwork skills. The way in which the module is structured allows you to reflect on your own personal development, which enables you to identify areas which require improvement more easily.”
“I would definitely recommend this module as it gave me some real hands-on experience of teaching.”

“Yes, definitely.”

2. Was the module helpful to you for deciding on your future career plans, and if so how?

“From doing this module it has set me up with the perfect platform to start my PGCE course. Furthermore it aided me in my interview as they were looking for students with some experience.”

“I wanted to become a teacher, however I was not completely sure, but having completed this module I have made a definite choice.”

“It made me realise that I would rather teach at secondary school than at college, which is what I initially wanted to do. It is great to have this experience if you are thinking about going into teaching and it looks really good in interviews for PGCEs.”

“Yes. After this experience I cannot wait to go onto teaching professionally.”

3. What did you learn about teaching pupils?

“I have learnt so much through this module as it has given me hands on experience in teaching pupils. I have learnt that no two days are the same, always be prepared as anything can happen, and each pupil is different.”

“Teaching pupils is an extremely challenging task, which does not just require patience but also creativity to be able to relate to all the pupils.”

“I learnt that teaching is a lot more than just imparting knowledge, and that it must be taken into consideration that each pupil is different.”

“It is important to know your pupils academically and otherwise, that way you can communicate better with them. There is also a great feeling of satisfaction gained from being able to teach them something they did not understand previously, or something new.”

4. What do you think the pupils gained from your being there?

“I hope with the help of my project I implemented, that the pupils worked with have academically moved up. In addition I hope that talking to these students and informing them that university is achievable has raised their aspirations.”

“The main thing gained by the pupils from my presence was the extra help and attention they received. Also many viewed me as a mentor, who can assist them in the choices of subjects for A-levels, and give them an insight on university life and maths as a degree.”

“Pupils gained support in their work and help in preparation for exams. Sometimes they found it easier to ask me for help than to ask the teacher as they could relate to me more. A lot of students asked about university and maths at higher levels and I tried to promote further education to them.”

“They were able to look at maths in a different light and inspired by the fact that I continued studying mathematics at university level. Most students I taught changed their views on maths as a subject and were more positive about it.”

B. Maths at work

In September 2008 we held a Maths Works event at Queen Mary. Eighty-two sixth-form students from Mulberry School for Girls and Bishop Challoner Catholic Collegiate School came for a day of workshops highlighting the different opportunities that mathematics provides.

We split the students into four groups and rotated them around four workshops. These were: a cryptography workshop run by Dr Hugo Touchette; a pharmaceutical statistics workshop run by GlaxoSmithKline statisticians Rachel Moate and Graham Archer, as part of their work for PSI (Statisticians in the Pharmaceutical Industry); an exploration of jobs in the financial sector led by myself; and a speed dating session involving a maths postgraduate student and professionals from the science, engineering and finance sectors. It was the week that Lehman Brothers filed for bankruptcy so finance was particularly topical!

Through my work with more maths grads, I have learnt that many London sixth-formers are not very impressed by salaries under £30,000. As a result I think it’s always worth putting salary figures in a broader context whenever talking about job prospects, and emphasising how graduate starting salaries compare with the current UK median salary – and the fact that not everyone getting a degree will get a graduate job!

Professional salaries and the respect that goes with a professional career remain an important motivation for many students. With our Maths Works event we enabled all students studying A-level maths to talk to professionals and ask the questions that matter to them, whether that’s about salaries, qualifications or how to choose university courses. Almost every student who attended said the day had been useful or very useful. The most popular session was the speed dating session: 47% found this very useful. Some of the students’ comments are given below.

“A great opportunity to talk to different people about their jobs, life at work, maths, A-levels, what we can do with maths, degrees etc - answered a lot of questions I had!” (Student, speed dating session)

“I found out about people’s choices and reasons for them and gained tips for my personal statement and student life.” (Student, speed dating session)

“It showed that maths was used in science and was fun.” (Student, pharmaceutical statistics session)
“It gave me new career paths without it just being accountancy.”  (Student, finance session)

“Interesting task. Good to hear from an economist too (HBOS)”  (Student, finance session)

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The challenges we faced included difficulties in getting rooms at Queen Mary at a suitable time for both the university and for schools: we don’t have suitable rooms available during academic semesters. We used the Science and Engineering Ambassadors’ Programme run by SETPOINT London to find suitable volunteers for the finance and speed dating sessions. No-one was prepared to run the whole finance session on that date but it was relatively straightforward to find professionals who could come for half a day and attend a couple of the speed dating sessions. Laura Thomas worked with us: she runs the administration for day-long taster courses delivered by academics which focus on university mathematics and complement this style of event.

Engineering outreach work has run events along these lines for several years, including events such as Engineering Your Future. The Maths Works style of event has also been developed more extensively by our colleagues Hazel Kendrick and Ruth Holland at the University of Leeds. Their Maths at Work sessions have been trialled with both Year 10 (first year of GCSE) and Year 12 (first year of A-level) students, and have proved extremely popular.

C. Enriching mathematics

University mathematics departments can also support outreach work in collaboration with local councils and maths education professionals. The more maths grads project provided this year’s funding for an ongoing collaboration between the London Borough of Tower Hamlets, Queen Mary and NRICH. The project involved NRICH (see www.nrich.maths.org) and 45 Year 8 mathematically-gifted pupils from seven different Tower Hamlets schools. Pupils came to Queen Mary for twelve sessions on Wednesdays through the year, from 4pm to 6pm, accompanied by a teacher. I also accompanied 28 of the pupils and their teachers on an enjoyable trip to Clare College and the CMS in Cambridge in March 2009.

This collaboration has now been running for five years and needs around £20000 per year to pay for the costs of NRICH staff, preparation and refreshments for students. As with all joint projects it requires everyone to do their bit: the School of Mathematical Sciences pays for student ambassadors, the council provides the necessary administration for free, and teachers give their time. It would be good to roll it out to other London boroughs but it is hard to secure long-term funding.

End note

The School of Mathematical Sciences at Queen Mary runs many other outreach programmes, including summer schools in mathematics and astrophysics for teachers supported by The Goldsmiths’ Company.

Laura Thomas runs other projects linking schools and Queen Mary academics in mathematics, statistics, astronomy and physics. Recently she and Professor Carl Murray won a London Education Partnership Award for the summer school programme Mediaspace. This uses the Cassini mission to Saturn to inspire pupils. See http://www.maths.qmul.ac.uk/schools/mediaspace for more details.

If other maths departments are thinking about how they can run events like these in their own institutions, we would be happy to hear from and talk with anyone who would like to learn from our experiences.