

Trajectory into mathematics teaching via an alternate route: A survey of graduates from Mathematics Enhancement Courses

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We report survey data collated from past Mathematics Enhancement Course (MEC) students. The survey is part of a larger project involving three UK institutions offering the MEC, a UK-based government initiative to address the shortage of secondary mathematics-teachers: whereby non-mathematics graduates enter the teaching profession via a subject enhancement course. We have reported qualitative aspects of this route (Adler et al., 2013; Hossain et al., 2013). Here we discuss the survey conducted to ascertain MEC graduate's experiences of appointment, retention and progression, and our interpretation of this as to whether the MEC with its particular focus on understanding mathematics in-depth is 'fit for purpose'. We asked ex-MEC students from three institutions to respond to an on line survey and 118 participated. Findings include that a large majority (100/118) secured and retained teaching posts, with some progressing in their positions in schools. Our study of subject enhancement courses as an alternative route into teaching emerges at a critical juncture given the cultural and political scepticism concerning such routes and their longevity in the current UK education climate.

Keywords: Mathematics Enhancement Course (MEC); Subject Knowledge Enhancement (SKE)

Introduction

We report survey data collated from past students on Mathematics Enhancement Courses (MEC). The MEC is one of the Subject Knowledge Enhancement (SKE) programmes available for graduates who need to develop their subject knowledge to teach pupils in secondary school. The survey is part of a larger project involving three UK institutions offering the MEC, one since its inception in 2004, and the other two since 2006 and 2007 respectively. For anonymity they are referred to in the paper as institutions A, B and C respectively. The MEC is a UK-based government initiative to address shortage of secondary mathematics-teachers, whereby non-mathematics graduates can enter the teaching profession by taking a subject enhancement course prior to their acceptance for a Post Graduate Certificate in Education (PGCE). We have reported qualitative aspects of this route; provided a detailed literature review; theoretical discussions about the MEC as a social practice and the students' talk of connectedness, reasoning etc. elsewhere (e.g. Adler et al., 2013; Hossain et al., 2013). Although there is some debate that the shortage of teachers may lead to employment/promotion and therefore does not fully reflect the capabilities of the teachers concerned - this remains a question for wider discussion. Here in this paper we present and discuss the survey conducted to ascertain MEC graduate's personal experiences of *appointment, retention and progression* only. We view these three

aspects of participation in the profession as indicative of whether the MEC, with its particular focus on understanding mathematics in-depth, has provided its students with sufficient subject knowledge for their future roles as secondary mathematics teachers, and thus whether the MEC can be considered ‘fit for purpose’. Although it would have been interesting to compare MEC graduates with non-MEC graduates who enter the teaching profession - this was not the particular focus of the survey data and scope of this paper.

We begin with a discussion of the notion ‘fitness for purpose’, and how our survey relates to the recent report *Evaluation of Subject Knowledge Enhancement Courses* published by the Department of Education (Gibson et al., 2013). This will highlight that our survey data on entry, retention and progression extends beyond that discussed in the DfE report, providing further substance to the notion of ‘fit for purpose’. We provide a brief history and description of the course before we turn to our on-line survey – its methodology and results. We will show that a large majority (100/118) of survey participants (i.e. past MEC students) secured and retained teaching posts, with some progressing in their positions in schools. We defined progression in terms of whether ex-MEC students are teaching A-level and/or holding positions of responsibility e.g. Head of Department, Head of Key Stage 3 (KS3). From this (and wider) data from MEC graduates who entered the profession between 2006 and 2012, we conclude that the MEC is, in terms of our definition, fit for purpose.

Alternative routes and their ‘fitness for purpose’

The notion of ‘fitness for purpose’ has been extensively debated as an indicator of quality in higher education (see for example, Harvey and Green, 1993). It is not our intention to rehearse these debates here. Instead, we use ‘fitness for purpose’ to refer to whether the MEC meets its overall aim: to enhance the subject knowledge of prospective teachers so that they can take up subject teaching positions in secondary schools. We have found it useful to draw in the ambit of the DfE report, and its evaluation aims and related criteria, and then add to these from our survey to fill out our notion of ‘fit for purpose’.

The DfE evaluation report aims, set in 2009, included:

Assess the effectiveness of the SKE courses in *preparing trainees sufficiently in their subject areas* to meet the Qualified Teacher Status (QTS) standards.

Evaluate the effectiveness of the SKE courses in *equipping trainees to become subject specialists in schools*.

Investigate any differences between traditional entry and SKE candidates during all stages of becoming a teacher (*successfully completing training, commencing teaching in schools, becoming high-quality teachers and progressing within the teaching profession*). (Gibson et al. 2013: 10)

Fitness for purpose as implied in the above, while still broadly defined, is that SKE courses provide students with sufficient subject knowledge to be able to embark on a PGCE ITE course as a mathematics teacher. The DfE report concludes that:

There is clear evidence in this evaluation of the success of SKE courses in preparing teacher trainees sufficiently with the subject knowledge they require, equipping them to specialise in teaching a subject in schools, providing an alternative route into teaching which is on a par with traditional entry teacher training and supporting the supply and quality of teachers into the profession. (Gibson et al., 2013: 16)

Close reading of the report reveals that much of it is based on reports of past SKE students, and, interestingly, this was done at three points in time: at the end of the SKE, during the PGCE and as a Newly Qualified Teacher (NQT). There is thus no data in the report that enables conclusions to be reached about retention in the profession and/or progression. Our view is that ‘fit for purpose’ must go beyond entry to include retention and progression. Our survey goes beyond the DfE sample to those in practice. We define ‘fit for purpose’ based on criteria for success according to the DfE (2013) survey study above (note the italicised elements in the aims), together with additional aspects of what is considered progression in teaching i.e. teaching A level classes, additional responsibilities related to mathematics teaching, belonging to professional organisations, holding other positions of responsibility, mentoring student and novice teachers and involvement in CPD.

MEC history and description

The Smith Report (2004) concerned with mathematics in the UK - identified the limited numbers studying mathematics at post-16 and degree level - envisaging a significant shortage of mathematics teachers unless action was taken. In response the DfE implemented at national levels the subject-knowledge enhancement course i.e. the MEC for aspirant teachers who did not hold a mathematics degree. This six-month (24 week) ‘mathematics subject knowledge for teaching’ course is completed before commencing ITE programmes. MEC courses have now been running across a number of institutions in the UK for about eight years. Graduates entering these programmes are required to have an A-level pass in mathematics, or some indication of post secondary study of mathematics. This varies across institutions. The MEC programme has provided an interesting context for the QUANTUM-UK study.

QUANTUM-UK project

The QUANTUM-UK study, funded by King’s College London, extends the on-going QUANTUM project. QUANTUM focused on qualifications for teachers under-qualified in mathematics (hence the name) in South Africa. Since 2003, QUANTUM has been investigating the kind of mathematics courses on offer across institutions - focusing on how mathematics comes to be constituted in and across courses that have both mathematical and pedagogical intentions. The rationale for the MEC in UK is to prepare non-mathematics graduates for ITE as secondary mathematics teachers. MEC programmes are focused on both deepening *and* extending mathematical knowledge in ways seen as appropriate to the profession of teaching. The significance of the MEC as an empirical site is not only that it provides an alternate route into teaching, but also that it offers an example where the specificity of Mathematics Knowledge for Teaching (MKT) is expressed through an explicit commitment in course materials to a ‘profound understanding of fundamental mathematics, emphasising deep and broad understanding of concepts, as against surface procedural knowledge’ (TTA 2003: 3).

The QUANTUM-UK study primarily contributed to the area of MKT. However, when presenting and discussing findings within the wider community we found there were strong underlying issues. Namely whether the six-month subject knowledge enhancement course could sufficiently cover the depth and breadth required for teaching mathematics. To what extent would successful MEC students be able to hold their own compared with mathematics graduates entering the teaching profession. Would they be viewed differently by employers and experience issues in securing teaching posts, and would their career trajectories be different? Given these

questions and the gap in the literature - especially in terms of studies/reports providing statistical data about MEC students or comparisons with non-MEC students, a survey study to gain knowledge of and insight into the positions and practices of ex-MEC students and their career trajectories as teachers was considered as one of the key parts of the QUANTUM-UK project.

At the same time the QUANTUM-UK study was unfolding - an evaluation of Subject Knowledge Enhancement (SKE) courses was being conducted by the Department of Education (DfE). The DfE report (Gibson et al., 2013), recently published, confirms aspects of our QUANTUM-UK research, in particular that the MEC is mathematically focused – appropriately on in-depth knowledge (Adler et al., 2013) and that it prepares the students well for ITE. While our survey findings were intended to fill a gap – in this paper we focus on elements that were not covered by the DfE study in terms of: ease of entry into the profession, retention and progression, i.e. the extent to which MEC is ‘fit for purpose’.

Research Methodology

The empirical work for the QUANTUM-UK study commenced in 2009, following ethical approval from King’s College London (and at a later date from Brunel University) and consisted of three phases. In phase one, in 2009, four MEC tutors and 18 MEC students across three institutions were interviewed. Phase two involved re-interviewing these students during their PGCE year in 2010. Phase three involved conducting a survey between March-April 2012, of these students (who would have now completed their NQT year and be in their first year of teaching) and other MEC qualified teachers in the profession in 2012. In this paper we only describe the survey study conducted and report our findings from phase three of the study.

Survey Study

A questionnaire was designed as a survey instrument that aimed to elicit the following information:

- Names and contact details to create a database of ex-MEC students so contact could be made for any follow-up enquiry/study.
- Background information - when and where they completed their MEC course and PGCE; whether they are currently in their NQT year; details of any further study pursued since completion of PGCE.
- To distinguish between ex-MEC students who had progressed into the teaching profession and those who had not. For ex-MEC students who had not progressed, questions were asked about any teaching experience and reasons for not pursuing the profession.
- For ex-MEC students who had progressed into the teaching profession – questions were designed to elicit information in the following four areas:
 - Ease of entry into the profession (Likert scale) and information/reflection about obtaining their first teaching post.
 - History of employment i.e. schools and types (state, independent, 11-18), duration of employment, positions, key stages taught, including work as a supply teacher.
 - Ease of progression within the profession (Likert scale) and whether this includes teaching A level classes; having additional responsibilities related to mathematics teaching within the school; progression in the wider community

in terms of belonging to professional organisations, holding other positions of responsibility; mentoring student and novice teachers and involvement in CPD.

- Information about other mathematics staff in their current department i.e. number of teaching staff and their background qualifications e.g. MEC plus PGCE; mathematics degree plus ITE/PGCE; non-specialists teaching mathematics; number of MEC trained teachers teaching A Levels.

The questionnaire was made available via an online survey tool. MEC tutors from three UK institutions (A, B and C) who were both participants and co-researchers/collaborators on the study located datasets containing names and email addresses of their ex-MEC students from cohorts ranging from 2004-2010 (A: 192 ex-students across 2004-2010; B: 144 ex-students across 2006-2010; C: 120 ex-students across 2007-2010). These included the 2009 cohorts from which we had interviewed 18 students during the MEC (June 2009) and followed them into the PGCE year (June 2010). Each MEC tutor sent a personal email inviting their ex-MEC students to participate in the study and directed them to the online survey.

The total number of students targeted through these email distribution lists was 456 - however it was acknowledged that given the time lapse not all email addresses would work. A total of 134 ex-MEC students initially accessed the online survey and there were 118 valid responses.

Survey results

Sample participant information

First we present some background information of the 118 participants. This is in terms of when and where they completed their MEC course and their subsequent PGCE course; whether they are currently in their NQT year and details of any further study pursued since they completed their PGCE.

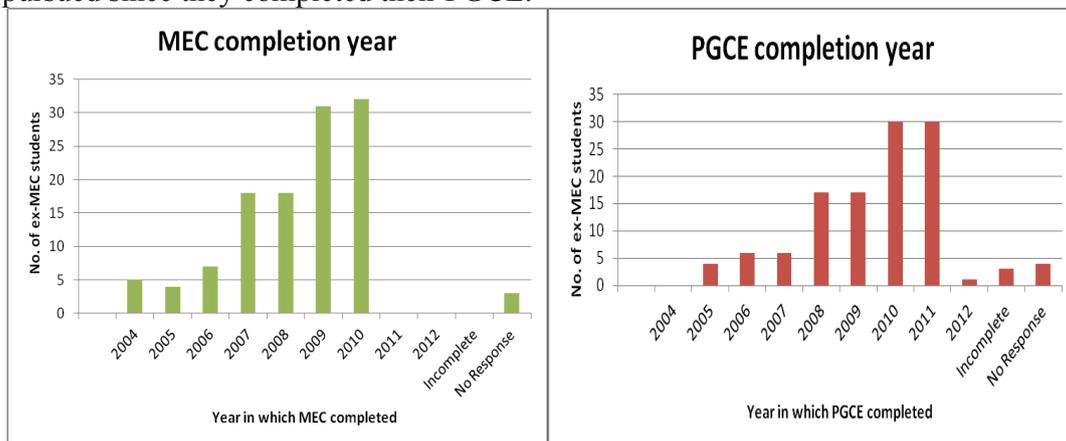


Figure 1 MEC and PGCE completion year

115 participants completed the MEC between 2004 and 2010. The higher frequencies from 2007 are because institutions B and C did not offer the MEC until 2006, whereas institution A piloted the MEC from its inception in 2004. The increased frequencies in 2009 and 2010 reflect substantial increases in allocations to MEC courses. 114 participants completed their PGCE between 2005 and 2012.

62 participants completed the MEC and PGCE at the same institution and 56 completed the PGCE at another institution. Figure 2 shows where participants

completed the MEC. 36 completed both the MEC and PGCE at institution A compared to 10 and 16 at B and C respectively. The high number of participants (29) who completed the MEC in institution B and then completed their PGCE in another institution was because institution B is part of a consortium and many students moved to another institution within the consortium to complete the PGCE.

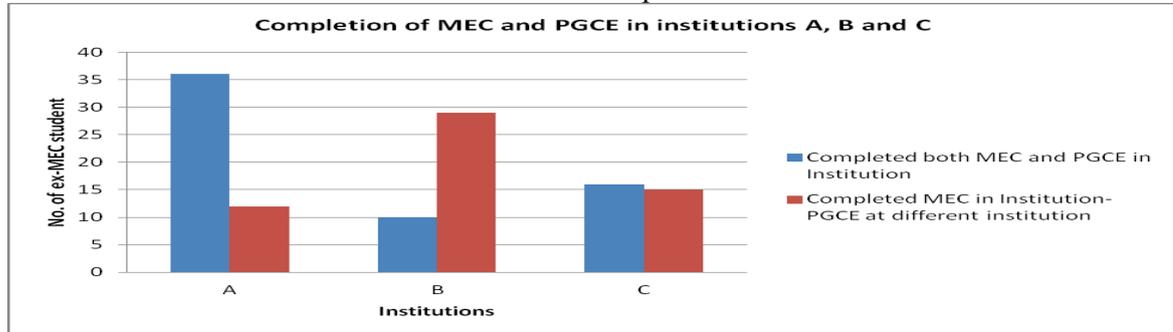


Figure 2 Completion of MEC and PGCE in same/different institutions

Given that the three institutions participating in this study were located across England i.e. North and South - with two from the opposite sides of London and the sample information shows our study participants - included MEC students from all of these three institutions over a period of time (ranging from 2004 and 2010) - we consider this to be a small but representative sample of the ex-MEC students' population.

NQTs in sample and further education

25 respondents were in their NQT year. They would have completed their PGCE in 2011 which suggests that five had not yet secured a post, or decided not to continue into teaching.

23 indicated that they had undertaken further study. The majority had pursued Masters in general teaching and learning/education but seven had studied mathematics - this included BSc in Mathematics (via Open University (OU)), module in pure mathematics (via OU) and Teaching Advanced Mathematics (TAM) course.

Participants within the mathematics teaching profession

A low number of participants 18 of 118 indicated that they had not pursued mathematics teaching. Their reasons included travelling, starting a family, behaviour issues in school and teaching being too stressful. These responses were considered to be generic in nature as they could pertain to any person deciding not to pursue a teaching career. Furthermore because these did not relate to the MEC or the participant's alternative route as a barrier to entry into and retention in the profession we do not elaborate on these students any further in the paper. We focus and present findings related to those who have progressed into the profession.

A total of 100 participants indicated that they had progressed into mathematics teaching and are currently working in schools. The number of years teaching experience varied from less than one to seven. A majority 63 of 100 participants indicated that they had at least two years' teaching experience. Participants in the profession responded to survey questions about their employment history. These included providing details about their NQT post to their most current post. Former MEC students are teaching in a wide variety of schools including secondary

comprehensive (state schools); independent schools; academies; faith schools; mixed and single-sex schools.

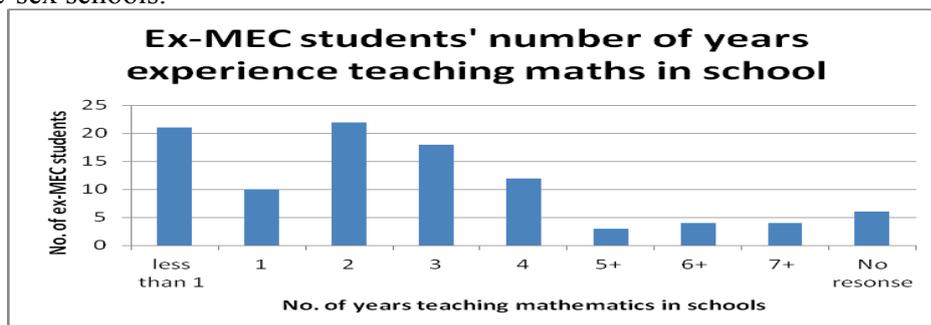


Figure 3 Number of years as a teacher of mathematics

In addition to securing posts as mathematics teachers, some hold positions of responsibility, including: head of department (2); deputy head of department (2); deputy head of house and senior tutor year group (1); assistant head of department (1); second in mathematics department (4); assistant faculty leader for mathematics (1); KS3 coordinator and foundation leader (2); subject/curriculum leaders in mathematics (3); head of year (1); examinations officer (1). All were teaching pupils aged 11 to 16. 32 indicated that they were also teaching A level mathematics.

First teaching post

Most participants reported that it had been easy to secure a teaching post whilst 12 indicated that it was difficult/very difficult. The survey also found:

- One in four secured a post or was offered a post in their PGCE placement school.
- 34 participants secured their first interview after one application. 32 participants made between two and six applications and seven participants made seven or more applications before being invited for interview.

Progression within the profession and in the wider community

83 participants responded to the question about progression within their teaching career. Of these, 45 participants indicated that progression had been easy/very easy for them; 10 indicated it had been difficult/very difficult. 25 participants indicated that they belong to a professional organisation compared to 62 who do not. Only 27 indicated that they mentor student and novice teachers. 51 reported that they are involved in various CPD activities.

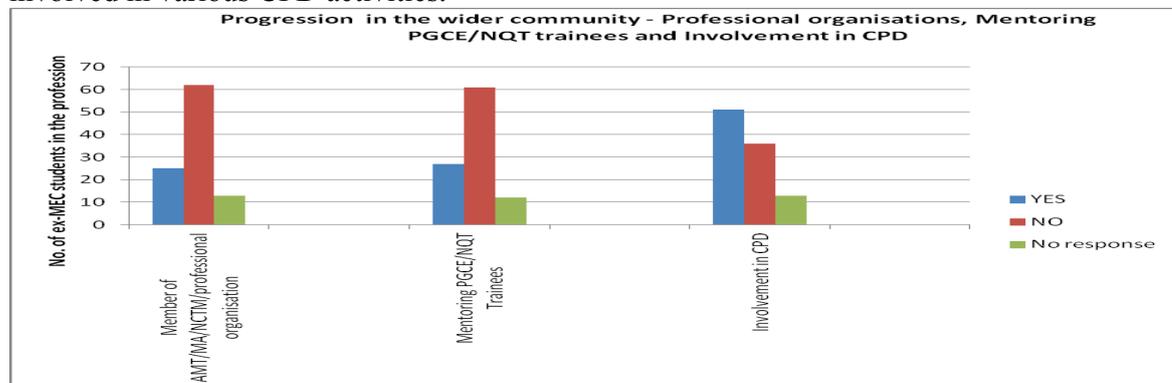


Figure 4 Progression in the wider community; professional organisations; mentoring; CPD

Discussion and conclusion

Our survey sample includes MEC students from 2004 to 2012, with teaching experience ranging from less than one year up to seven years. We go beyond the DfE (Gibson et al., 2013) study that focused on MEC, PGCE students and NQTs. We provide insight into the retention and progression of former MEC students. We found the majority of MEC students (100 of 118) progressed into the mathematics teaching profession. Most secured their first teaching post easily: 25 employed or offered a post in their PGCE placement school; approximately one in three indicating they had been invited for interview after their first application. Our results suggest MEC students did not face barriers to entering the profession despite their MEC route. This is confirmed by the DfE study (Gibson et al., 2013) in which their NQTs also indicated the ease of entering the profession. A large majority of our participants indicated that progression had been relatively easy. Many hold positions of responsibility in mathematics and pastoral care. The DfE survey explored participants' career aspirations and our survey evidence confirms these aspirations are realised in practice. The DfE report (Gibson et al., 2013) suggests that science and mathematics teachers have sufficient subject knowledge to teach 11-16. Although some NQTs teach A level mathematics, confidence about teaching at this level seems less secure. Our data shows approximately 30% of participants are teaching A level mathematics.

Overall our results indicate MEC students' entry, retention, progression in the profession seems to be 'normal' i.e. they generally do not face barriers/challenges given their alternative route. Hence confirming the MEC is 'fit for purpose' (as defined and interpreted within the context of this paper) and supports the DfE finding that SKE courses provide "an alternative route into teaching which is on a par with traditional entry teacher training and supporting the supply and quality of teachers into the profession" (Gibson et al., 2013: 16). We hope this paper provides evidence about the value of these courses in enabling non-traditional entrants to become subject specialist teachers. We also acknowledge it would be interesting to pose questions in relation to trainees with mathematics degrees i.e. whether MEC students apply for the same posts as other PGCE students? And ask wider questions as to whether MEC courses run in parts of the country with a significant shortage of mathematics teachers - as areas for future study.

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