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**Mathematics Development Programme for
Teachers (Pilots)**

External Evaluation for TDA

End of Year 1 Report

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Centre for Education and Inclusion Research

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1. Background

The Mathematics Development Programme for Teachers¹ (MDPT) pilots are continuing professional development courses for non-specialist teachers of mathematics. Non-specialist teachers of mathematics are teachers who teach mathematics, for all or part of their teaching timetable, but who do not have a post A level qualification in mathematics or in mathematics education or another relevant qualification. The MDPT pilots are a significant professional development initiative that contributes to reducing the number of mathematics lessons taught by non-specialist teachers, a key concern identified in the Smith Report² and more generally to improving the quality of mathematics teaching in England.

In autumn 2006 the TDA invited bids to run three MDPT pilots. The MDPT specification allows for up to 30 days of structured professional development activities with a further 10 days of supported school-based activity. The courses are required to support development of mathematical knowledge in the context of professional development as teachers of mathematics, so developing both subject and subject specific pedagogical knowledge. The aim is that on successful completion, participants will be able to teach their subject effectively, with enthusiasm and confidence, to learners aged 11–19 years in schools or further education colleges. Two key features of the courses are the need to address the individual needs of participants and to offer certification of learning. To be eligible participants must have at least one year's teaching experience, teach mathematics as part of their timetable, not have a teaching qualification in secondary mathematics nor a degree in mathematics or a mathematics related subject.

In January 2007 the University of Brighton, Liverpool Hope University, and the University of Wolverhampton were awarded contracts to develop pilot courses and recruit participants. The numbers of participants who began the courses are given below with the number who have continued to attend fully or nearly fully given in brackets, numbers for completion in terms of accreditation are not yet known:

Brighton	13 (11)
Liverpool Hope	18 (16)
Wolverhampton	12 (8, plus 1 participant partially attending)

Further information about course participants is given in Annex 3. Towards the end of the recruitment process the TDA was able to secure additional funding to cover supply costs for the release of teachers from school. However, this came too late in the process to have any significant impact on participant numbers. During the first year of the pilots further funding was announced to offer participants a financial incentive on successfully completing the programme and gaining accreditation.

¹ During Year 1 of the Evaluation the pilots were known as Mathematics Development Programme (MDP) pilots. In Year 2 and for national roll out the courses are known as Mathematics Development Programme for Teachers (MDPT) so for consistency this name is used in this report to refer to the Year 1 pilots.

² Smith, A (2004) Making Mathematics Count: The report of Professor Adrian Smith into Post 14 Mathematics Education. http://www.tda.gov.uk/upload/resources/pdf/m/mathsinquiry_finalreport.pdf

The Centre for Education and Inclusion Research at Sheffield Hallam University was commissioned to conduct an evaluation of the pilots. The evaluation aims are:

Aim 1: The contribution of the pilot courses to increasing the subject and subject specific pedagogical knowledge of participants.

Aim 2: The effectiveness of course providers in identifying and meeting the Individual development needs of participants.

Aim 3: The outcomes achieved by course participants in relation to their individual starting points.

Aim 4: The effectiveness of the quality assurance approaches developed by the course providers.

At the request of the TDA the methodology for the evaluation was designed to support ongoing quality enhancement and sharing of good practice across the pilots through frequent informal and formal reporting to both the providers and the TDA. As would be expected during pilot courses, providers have made changes to their courses in response to their own and our evaluation.

Key features of the methodology for Year 1 of the evaluation:

- Documentary analysis of course handbooks and other materials.
- Visits to providers (three visits per provider) for observation of course sessions, interviews with providers, surveying of all participants and focus group interviews with at least four participants per provider during each visit.
- Identification of a sample of twelve participants for tracking and school visits.
- Visits to these twelve participants (four per provider) at their schools for interviews, lesson observations and meetings with school leaders.
- Analysis of focus group participants' assessed work.

Subsequently the methodology was extended to attempt to gather data on the impact of the courses on the experience of the pupils taught by participants through surveys of pupils by participants.

The interim evaluation reports influenced the TDA design of specifications for the national roll out of the MDPT courses. Year two of the pilots is now underway and the evaluation of year one and ongoing evaluation of year two are intended to inform further developments to the programme.

2. Evaluation team

Team Leader: Mike Holland

Principal Mathematics Evaluators: Tansy Hardy and Mark Boylan

Principal Science Evaluators: Mike Holland and Terry Hudson

3. Evaluation activities

Visits to providers

Each provider was visited on three occasions between June 2007 and July 2008. Providers were visited before or at the start of the courses in June to September 2008, a second time in October to December 2008. The third visit to each provider took place in May/June/July 2008.

Activities during visits included:

- Observation of course sessions including taught sessions and assessed presentations.
- Informal discussions with a wider group of participants during each visit.
- Interviews and discussions with course tutors and other key provider staff.
- A participant survey completed by all participants (see Annex 1 for outcomes) in autumn 2007/spring 2008. The survey was conducted at different times with different groups and therefore responses for different providers are not strictly comparable.
- Interviews with a focus group of four participants from each course (12 participants in total) in the autumn and in the summer terms. The focus group participants represent the range of the diverse nature of participants on the courses (see Annex 2).
- Collection of documentary evidence: course handbooks and session plans; assignment briefs; participant information.
- Collection of assessed work.

Following each visit to the provider a visit report was sent to the provider for checking and comment.

School visits

Eleven of the twelve focus group participants were visited in school (the visit to the twelfth participant was postponed due to family illness). During each visit a lesson or part of lesson was observed and participants interviewed, and where possible, discussions with other interested staff in the school such as Heads of Department and CPD co-ordinators took place. Some informal discussion with pupils about their learning experience was possible in some cases.

In addition six participants who were visited in school in the autumn term were contacted in the summer by telephone or email and asked follow-up questions about their experience of the year as whole. Three of the six responded.

Other evaluation activities

As part of the evaluation examples of assessed work were collected. Course assessment patterns and institutions' assessment arrangements meant that a full sample was available from two of the providers with the third providing a partial sample at the time this report was finalised. Assessed work was evaluated with reference to the evaluation aims.

Following the request from the TDA, we have additionally attempted to gather evidence from pupil voice from the focus group teachers. Due to the timing of this (summer term) or circumstances of particular teachers (e.g. working in special educational provision) this has not been possible in all cases. However, 5 of 12 teachers in the focus group are stated their intention to send the evaluation team the results of a survey undertaken with one of their groups of pupils. To date one participant has done this.

Attendance information is being collated from each provider as it is received. Participant and tutor internal course evaluations are also expected in the near future. An interim summary of emerging findings was prepared for TDA in June 2008 to inform the proposed roll out of the MDPT.

This end of year report builds on that Interim Summary and Interim Report 1 (October 2007) and Interim Report 2 (March 2008) to give an overview of the evaluation findings so far and key points that have emerged over the year as a whole.

Phases of the evaluation

The evaluation during Year 1 was conducted in five phases, during each phase data gathered was analysed.

Phase 1: scoping phase including refining methodology with TDA and provider representatives.

Phase 2: first provider visit including collection of data on recruitment, selection, course design and initial needs analysis; meeting with whole cohort to discuss evaluation; identification of focus group participants.

Phase 3: second provider visit including focus group meeting, participant survey, observation of teaching session; first school visits (2 per provider) which included interviews with participants and meetings with school leaders.

Phase 4: third provider visit including focus group meeting, observation of sessions, and discussion of assessment approaches; second set of school visits (2 per provider) including interviews with participants and meetings with school leaders.

Phase 5: collection of documentation from providers, including course evaluation materials, samples of participant assessed work.

4. Overview

All three pilots were broadly successful in the first year in recruiting viable cohorts and in offering a valuable professional development experience, leading to successful completion of the courses by nearly all starting participants. All providers have achieved admirable outcomes in relation to the resources available.

Providers have adapted course content to meet the needs and interests of participants. In general this has led to a greater emphasis on pedagogical subject knowledge and issues

specific to mathematics teaching than initially planned for. They have encouraged participants to attend all planned sessions rather than the more flexible and individually tailored programme envisaged in the course specification and bid documents.

Focus group interviews, the participant survey, informal conversations and individual interviews, all indicate that participants are generally very positive about the opportunity the courses offer. Overall, participants are satisfied about the contribution the courses are making to subject knowledge and pedagogical knowledge.

Participants' Heads of Departments are also positive about the contribution the course is making to professional development. Those participants in school environments with a collaborative culture have shared some of the benefits of the course with other colleagues. Evaluation evidence indicates that participants are making good progress and in some cases very good progress in terms of subject knowledge and/or pedagogical knowledge development.

5. Evidence in relation to Aim 1

The contribution of the pilot courses to increasing the subject and subject specific pedagogical knowledge of participants.

5.1 Course structure and attendance

All three courses offer different structures to support participants' needs. There is no evidence that any one structure has any particular benefits in terms of participants' progress. (Future providers should be cautious about including Saturday sessions if cover costs are available). See Annex 1 for further details on the course structure.

We note the difficulties and costs for providers in resourcing school visits particularly when teachers are attending from locations that can be several hours travelling in some cases. Within the limited resource available providers are faced with a difficult choice between being able to make school visits and maximising the number of taught sessions and face to face feedback.

Initial bids and course documentation indicated that participants would be likely to attend a variable number of sessions depending on needs analysis. In practice providers have found it appropriate to encourage participants to attend all sessions and most participants have been keen to do so. Given that this course is both about subject and subject pedagogical knowledge, providers have taken the view that participants benefit from attendance at all sessions and should be encouraged to attend all. For example, if a participant has a strong statistics background, from a degree in economic history, they are likely to be competent in terms of statistics procedures but they may be lacking in knowledge of how to teach statistics, including pupils' misconceptions, motivating and engaging activities for different ages of pupils and so on.

Participants in interviews have generally appreciated attending all core sessions with only a few exceptions. Some individuals appear to have chosen not to attend sessions on occasion if they felt it was not personally relevant (for example on teaching A level topics).

Providers had identified that these participants should attend the sessions but the participants chose not to as they did not think it was relevant to their future teaching. We believe that there is an issue of expectation management, for example by reviewing course publicity material. Some early discussion with participants of the reason for the course design and coverage may also help. Specifically, participants need to be convinced that even if they are not intending to teach A level topics or higher GCSE, the study of A level topics and higher GCSE is important to 'know where the pupils are going'. Study of such topics will help develop the depth of understanding to teach mathematics at KS3 in a way that promotes pupil engagement and understanding. Both the recruitment and needs analysis processes offer opportunities to engage in discussion with participants about this.

At the same time it is also important to recognise that participation in the course is a significant commitment both for the participants and their schools and it may be the case that the few participants who chose not to attend some sessions may be making strategic decisions about how to maximise the benefit of the course to them. Clarifying the relationship between course attendance, course completion and receipt of the financial incentive may be beneficial.

Overall attendance on the courses has been good with high attendance maintained over the year. On one course attendance overall was lower. On this course two participants (of twelve starters) stopped attending relatively early on. The participants were both senior teachers and in one case a change of head teacher meant that support for attendance was withdrawn. A third participant on this particular course, also a senior teacher, reduced their attendance in the second half of the year due to school commitments.

5.2 Course content

In devising the detail of the course content, providers have selected a range of appropriate opportunities to develop a deep understanding of fundamental concepts in mathematics. This is done in the context of introducing or reacquainting participants with a wider range of mathematical topics. As would be expected there is considerable overlap between content coverage among the courses although some differences. There is no evaluation evidence that these differences lead to significant differences in outcomes.

All three providers have adapted the content of the course in response to their analysis of the needs of participants. In this regard the views of the participants have been an important influence. In general this has led to a shift in the balance of content from subject knowledge to increase the opportunities for subject specific pedagogical knowledge and other teacher professional knowledge, such as awareness of specific teaching resources and teaching skills. This has led to less time spent on and less coverage of mathematics than was initially envisaged. At the same time providers have justifiably resisted the initial desire of participants for an overriding focus on techniques and activities that could always be put to immediate use in the classroom to maintain a focus on depth of understanding appropriate to subject specialism.

Participants valued the opportunity to deepen their understanding mathematically, comments on this included: "it's important to have deep knowledge, not just to follow a recipe" and to be able to present concepts in a variety of ways summarised as, "our

knowledge needs to be there because pupils might do things in a different way [to the way I learnt to do it], and we need to know the reasons and not only the way that I do it".

We note the tensions and difficulties for the providers in addressing the wide variety of participants' needs in the time available. Although participants do express a desire for the inclusion of activities that are of immediate use in the classroom by the end of the course all interviewed also appreciated opportunities to develop more in-depth understanding and confidence. In terms of prior subject knowledge, participants' qualifications are either National Qualifications Framework Level 2 (GCSE A*-C equivalent), approximately, 60%, or Level 3 (A Level), approximately 40%. All courses include opportunities to develop deeper understanding of Level 2 topics and some exposure to Level 3 (A level equivalent). They also offer opportunities to experience at least an aspect of Higher level study.

Some participants interviewed commented positively on individual sessions where they engaged with Higher level mathematics as these helped to increase confidence in themselves as mathematicians. A wider number of participants clearly engaged enthusiastically with topics from the A level curriculum. A minority of participants found work at this level a struggle.

It is clear that in terms of developing both subject and subject pedagogical knowledge the time available on this course is limited. Given this we recommend that an additional course aim should be for participants to devise explicit strategies that will help them to engage in continued learning of mathematics after the course has finished as independent learners. The development of such skills might be a worthwhile focus for assessment. All courses are achieving this to at least some extent even where it is not an explicit course aim.

5.3 Teaching

All providers have offered interactive high quality learning environments. The participants have been encouraged to link their learning to their school/college context. This was done in some sessions through discussion of what had arisen in their work context over the previous week together with discussion about how particular approaches would work with their students.

Examples of good practice include:

- Use of existing recognised high quality training materials such as 'Improving Learning in Mathematics' and use of the NCETM self-evaluation tool.
- The modelling by tutors of effective classroom practice.
- The contribution of experienced and skilled local mathematics teachers to courses.
- The good variety and high quality of teaching materials provided to participants.
- Teaching and learning strategies that enhance peer learning and the development of learning communities, including peer learning/tutoring as a differentiation strategy.

All providers offered a range of individual tutorial provision.

5.4 Peer learning

All three providers have been successful in developing a learning community amongst the participants. One provider had included an early residential experience for participants. In this course some of the participants had developed an informal network to phone and text each other about course matters and had arranged some peer observations or visits to others' schools. In one interview the residential experience was cited as valuable in developing trust and making connections quickly with colleagues in similar situations.

The participants valued highly the opportunities to share ideas and experiences with colleagues who work in other settings or in different schools. They repeatedly emphasised the very high value of their peer discussions (both in and out of sessions) in helping them relate work in sessions to their local context. The interaction with peers was particularly valued by some of the participants who experience a degree of professional isolation in their workplaces either for those do not work in a mathematics department (e. g. as an SEN specialist) or due to their status as 'non-specialist'. In some instances participants arranged to sustain this peer support into the next school year.

5.5 Course materials

All providers provided participants with materials that either can support effective teaching of mathematics or can support further development of subject knowledge outside sessions. In focus groups and individual interviews this was identified as a positive feature of the course; particularly valued were materials to support effective use of the IWB.

5.6 Staffing

The three courses are staffed in different ways. One course is taught by three course tutors who are all permanent members of staff. A second has one main tutor plus drawing extensively on other colleagues and additional school teachers. The third is taught by an experienced consultant as course tutor who draws on the support of other university staff particularly in relation to assessment. There is no evaluation evidence that any arrangement is preferable in terms of the quality of teaching provided (see below for issues relating to support in school/college). All or nearly all of the teaching on the courses is by tutors with experience in mathematics education in schools and/or colleges. The tutors also have experience of subject knowledge development in initial teacher training (ITT) and developing and assessing subject pedagogical knowledge in ITT. This allowed for integration of subject knowledge and pedagogical development on the MDPT courses. Interviews with participants indicate that they welcome this.

5.7 Support in school/college

This varies considerably as might be expected. Some participants work part time or are supply teachers and attended the course in effect in their own time. One participant works in a department in which there are no specialist trained mathematics teachers, whilst other participants are fortunate to be in departments with skilled and experienced colleagues who are actively supporting participants' development through peer observation, mentoring and collaborative working.

One provider (Liverpool) required participating schools or colleges to nominate a mentor for each participant. When no such mentor was easily identifiable tutors have discussed with participants other forms of support. Whilst this provider clearly cannot maintain the same level of assurance of quality for such support as, for example, with ITT provision, it at least raises the issue of the school or college's responsibility in the professional development of non specialists with the schools and colleges concerned.

School leaders interviewed requested that providers improve communication with school CPD coordinators/HoDs at an early stage of the course about course content and structure, aims and objectives, assessment and other significant issues. One way of doing this may be for providers to develop a short briefing document about their course for this audience. However, from interviews conducted we believe that in addition direct communication with school leadership is important.

When asked for potential improvements in course design, a number of participants expressed a desire to be able to observe experienced and skilled teachers in school settings other than their own and as noted above, some teachers have made informal arrangements to do this or to conduct peer observations. We believe that these types of arrangements could be formalised as part of the MDPT courses.

In the original course designs all three providers aimed to visit participants in schools. In year one, only one provider visited as planned with some participants visited twice. A second provider has rescheduled visits to autumn 2008 to support action research projects. In the third course visits did not take place due to due to unexpected additional responsibilities of the key tutor. We have been assured that next year visits will take place. A significant factor with regard to visits was the unanticipated geographical spread of participants which meant that significantly more time than expected would be needed if all participants were to be visited.

We note that the provider which did succeed in making visits as planned has a core teaching team of three staff. This meant that each tutor had a more manageable number of visits to make. With only one key tutor, visiting all participants may have been too demanding. Generally, courses will be more resilient if there is a team of staff. The issue of overall resource for the MDPT courses is outside the evaluation aims. However, both the overall resource available and resource allocation to different activities may be important with regard to tutor visits. Where visits are possible we believe that visits to those participants who lack adequate support in school should be prioritised.

5.8 Assessment, feedback and accreditation

Providers used both informal and formal assessment strategies which both assess the development of professional knowledge and in themselves offer opportunities for learning. The emphasis early in the courses is on formative assessment.

All providers offered on-going informal feedback through a variety of mathematical tasks that inform on-going identification of development needs. The development of skills profiles/portfolios has been approached as a year long task by two of the providers. The tracking of development needs has been only done informally this year in one course with no written profile or portfolio. We consider this more fully below in discussion of Aim 2.

Assessment and feedback of subject knowledge development as distinct from subject pedagogical knowledge on the courses is largely formative and involves self-assessment. All courses do, however, include assessment activities that involve participants' study of self-selected mathematical topics. The assessment and tracking of subject knowledge per se is a relative weakness (that is relative to course strengths).

All providers offer initial tasks either before or at the start of the course, predominately self assessment, as the basis of individual needs analysis. At two courses initial subject knowledge analysis was followed up and formative (oral and written) feedback given later in the year. Moreover two providers have included the tracking of the development of subject knowledge and subject pedagogic knowledge as part of the assessed tasks. These tasks also require the identification of areas for development and evidence of addressing these. For some this included identifying weaknesses in pedagogic strategies relevant to subject teaching as well as an understanding of an area of maths that supports teaching that area.

Providers have recognised the need to strengthen the ongoing assessment of subject knowledge. There has been interest from providers in the new NCETM online self assessment materials which are a good example of how to address this issue enabling teachers to monitor and self assess their subject knowledge.

Subject pedagogical knowledge was formally assessed on the courses through presentations and written reports and formed the major part of the summative assessment arrangements.

All providers also used assessment tasks related to developing an area of maths at the teachers' own level and reflecting on their own learning both in terms of their new understanding and the learning experience. Other assessment tasks focused participants' attention on implementing their learning (both in mathematics and in related pedagogy) from the course in the context of the classroom. Participants' remarks indicate that for many their engagement in this process has encouraged a more adventurous approach to planning. All providers included tasks that required participants to interrogate research findings and evidence on mathematics teaching and learning and relate this to their practice.

Overall, the assessment tasks represent good appropriate challenges that not only assess learning but are useful vehicles for developing participants' knowledge. This is certainly how many participants describe their engagement with these tasks. On all three courses, we spoke with participants who had found the assessment tasks useful in terms of developing their classroom practice. It was felt that there has been good support by tutors for participants in these formal assessments. Assessment outcomes are considered below in relation to Aim 3.

On the one course where tutor observation of participant teaching has taken place, feedback given was formative not evaluative and outside the formal assessment structure.

The accreditation of the programme is offered by all providers through a *Higher Education or Post Graduate* certificate at either Higher Education (H) level or Masters (M) level. The related assessment tasks have either been designed or developed specifically for this

course or are adaptations or specific implementations of pre-existing assessment tools such as generic modules that support individual CPD.

One provider is offering accreditation at H level with the possibility of M level extension, one provider both H level and M level routes, and one provider M level only.

Earlier in the year, some participants questioned the scope of the assignment tasks, particularly the need for these to be at M level. Where only M level assessment routes to completion are offered, some equity issues have emerged, not least in regard to the financial incentive. Where this is the only means of accreditation, teachers who have decided not to undertake the M level assessment tasks - for reasons such as the time involved, lack of confidence in writing and analytic skills and other personal circumstances - are forgoing the possibility of the financial incentive. It is not clear how these participants' learning in the subject will be accredited. Where only H level assessment was offered one participant interviewed regretted that her progress could not be assessed at M level. The greatest satisfaction with the assessment arrangements was expressed where participants had the choice of level of assessment. The fact that on one course two participants who were enthusiastic participants but chose not to seek M level accreditation, with the possibility of not receiving the financial incentive, illustrates the complex relationship between motivation, accreditation and financial incentives.

All participants interviewed recognised and valued assessment beyond a certificate of attendance. They felt strongly that the assessment tasks should provide evidence of their engagement with mathematics as learners and also their ability to take that learning into the practical context of the classroom and to plan and manage engaging, productive learning experiences in mathematics for their learners.

At this final stage of the course many participants commented on the greatly increased workload that completing the assessments brought. This was particularly acute for courses where the assessed work was concentrated at the end of the course. Two providers mentioned planning to bring some assessed tasks into the earlier part of the programme in 08/9. From the survey we note that many participants are finding the additional workload for personal study outside of the course days difficult to manage. However, in practice very few have used the additional 10 days available to fund their release for their studies.

6. Evidence in relation to Aim 2

The effectiveness of course providers in identifying and meeting the individual development needs of participants.

6.1 Recruitment strategies and enrolment

As previously reported, providers have used a variety of successful strategies for recruitment such as promotion with partnership schools and through local networks, attractive coloured leaflets, letters to heads of departments and head teachers and web based advertisements including through the NCETM portal.

Recruitment for the mathematics pilots was initially slow. There were a number of recruitment-related concerns evident in June and July 2007 when our first visits and discussions took place. Often, successful recruitment resulted from direct contact of schools and colleges and providers have made considerable efforts in following up initial contacts with schools and persevered to secure viable group sizes.

From discussion with a number of participants, the cost of supply cover was a key factor in allowing for at least some teachers' release. In general programmes were planned on the expectation that teachers would be drawn from reasonably local schools. In practice recruitment in all cases was from a widely spread area. Providers have been creative in adapting the courses to address this issue.

We note the successful recruitment for year two of the courses. There is evidence that some of the teachers in the new cohort have been recruited at least in part due to the direct or indirect influence of the current cohort (for example, colleagues of this year's participants). There is some evidence that the MDPT courses are already beginning to develop a reputation as a successful 'brand', in a similar way to MEC that can help address mathematics specialist teacher shortages. Such word of mouth recruitment is a significant sign of the success of the pilots thus far.

The participant survey confirms the comments made in the first interim report that all providers had in place effective initial needs analysis. In interviews and discussion the practice by one provider of the course leader having an individual telephone discussion with participants before joining the course was positively commented on.

6.2 Initial needs analysis

In the first part of their course, providers offered GCSE and Key Stage 3 SATs papers to enable participants to start the needs analysis process. These were used for the participants to reflect on and self assess in terms of areas for development in subject knowledge and their understanding, together with an indication of their comfort level. In one provider this had only been done informally for 07/08, and the participants suggested the need for a more formal tracking system for the next cohort.

As started earlier we are aware that all providers are considering the suitability of the new NCETM on-line self evaluation materials as part of the needs analysis process and potentially as a teaching and learning tool. These materials are a good example of how participants could follow up their identified needs. Regular use of these materials at key points in the course linked to self, peer and informal tutor assessment and feedback specifically focused on subject knowledge would be one way of addressing this issue of on-going monitoring and self assessment of subject knowledge.

The MDPT courses require providers to conduct needs analyses that includes subject knowledge, subject pedagogical knowledge and analysis of context needs. This a challenging task and one that has not been attempted before or at least not recently in terms of qualified teacher CPD. It is not surprising that providers may have underestimated the extent of this task or of the on-going challenge of documenting progress in all areas or that suitable approaches will need time to develop. All providers

have identified that this is an area for improvement. We would encourage in particular a more rigorous approach to documenting all aspects of participants' progress on the course.

All the participants interviewed felt that their individual development needs were being met. Participants on all courses experienced tutors as available for individual support as and when needed. There was also a general appreciation of the way in which course activities had been amended or adapted to support the particular needs of the cohorts tutors are working with.

During observations of teaching sessions at all three providers, participants were given opportunities to engage in activities at a level appropriate to them. Addressing individual needs during sessions was most successful where participants were given extensive scope to explore tasks either alone or in groups. Given the diverse nature of the course participants their generally positive views of the course are testament to the way all providers are effectively addressing the participants' different needs.

7. Evidence in relation to Aim 3

The outcomes achieved by course participants in relation to their individual starting points.

Focus group participants visited in school and others on the course interviewed have all made good progress in terms of professional development as mathematics teachers. In a number of cases the outcomes that participants are experiencing are above their own expectations.

For example, one participant who was teaching mathematics as part of Key Skills in FE has now trained as the Subject Learning Coach in mathematics for her college and is looking forward to teaching GCSE and possibly moving into a career in mathematics teaching in schools. An experienced teacher working in a Young Offenders Secure Unit now has aspirations to work in mainstream education to teach Higher levels of GCSE. Two of the participants on one course who joined the course aiming to only improve their Key Stage 3 teaching are now looking forward to teaching GCSE. A relatively recently qualified teacher now feels confident to develop her career to seek leadership positions in mathematics education.

Interviews with school leaders in participants' schools confirm the progress that participants have made, with all school leaders commenting positively about the impact of the course on the participants' teaching and contribution to departments. Several have reported being 'taken more seriously' in their department and now being included more in departmental discussion. One reported that his teaching and enthusiasm in school had been highly praised by a senior teacher and that this had led to an agreement to fund new mathematics resources.

Several lessons taught by participants that were observed were excellent, others less productive in terms of pupils' learning. In the most successful lessons, participants emphasised links between mathematics ideas and offered strong modelling of mathematics language. Most observed lessons included an appropriate level of

mathematical challenge for all students and a general feature was the attempt to engage pupils in mathematical thinking.

Observations of a number of participants evidenced approaches to teaching and learning that were innovative and indicated a reflective approach on the part of the teachers concerned. Post-observation discussions with participants indicate that all observed have changed their classroom practice positively as a result of being on the course. These changes include a more active approach to learning including the use of engaging starter activities, an emphasis on pupil engagement and supporting pupil thinking skills. A focus on teaching for understanding was observed in several lessons.

There were examples, however, where teachers' own knowledge of mathematics was apparently good but they appeared unaware of key questions to ask; this indicates that depth of understanding of mathematics is not uniformly present. Weakness in subject knowledge was also observed at times. However, it should be noted that in terms of mathematical background some participants enter the course with mathematics qualifications that would mean they were unlikely to achieve fluency over the period of this course with the mathematics needed to teach all aspects of GCSE courses. (Note that these participants would not for example have been eligible for entry to a mathematics enhancement course).

Participants linked their own increased confidence in mathematics to their desire to offer more challenging activities to pupils. In addition to developments in subject knowledge and subject pedagogical knowledge it is clear that the courses are also leading to professional development in terms of two other key areas of professional knowledge. These are summarised as 'Attitudes' and 'Knowledge of Pupil Development'³.

Evidence from assessed work is consistent with other evaluation data that significant progress was made by participants. For example, the portfolios and reflective diaries for the focus group on one course clearly showed their engagement with the process of learning mathematics. The assignment demonstrated that they were able to explore and evaluate teaching guidance and resources and use this to inform their teaching practice. The course (including peer group learning) had given them access to valuable resources and strategies and encouraged them to try unfamiliar teaching approaches. The record of the school visits by tutors included in the files provides further evidence that the course participants have been able to use guidance to inform and develop their teaching practice in mathematics.

The strongest assessed work showed that these participants had a good understanding of interrelationship between research and practice and were able to reflect critically on their own learning and use this to develop effective teaching of mathematics topics. Weaker portfolios and diaries tended to be a little sporadic and fragmentary. Whilst the collection of articles provides evidence that the students are engaged in purposeful reading of professional literature, they did not always show clearly how their engagement with the ideas in the articles moves beyond 'good activities for the classroom' to critically reflect on pedagogic issues.

³ TDA (2007) Developing trainees subject knowledge for teaching.
http://www.tda.gov.uk/upload/resources/pdf/s/subject_knowledge07.pdf

In addition to reviewing samples of assessed work for all three cohorts, we also observed assessed presentations of the whole of one cohort. These presentations reviewed research evidence on a new-to-them teaching strategy or related issue and identified actions to take to make changes in their classroom practice. The standard of presentations was extremely high and it was clear that the participants had challenged themselves to connect their new knowledge about learning mathematics to develop more productive and innovative forms of teaching the subject.

We conclude from the assessment samples and from observation that all participants have successfully learnt some mathematics that is new for them as well as developing subject pedagogical knowledge. Importantly, the nature of the assignment tasks means that there is also evidence of the ability of the participants to take responsibility for their on-going development of subject and subject pedagogical knowledge.

Fuller documentation of participant progress across the whole range of course aims and personal professional development goals will allow for a fuller analysis of patterns of progress of particular individuals.

8. Evidence in relation to Aim 4

The effectiveness of the assurance approaches developed by the course providers

In all cases accreditation is integrated into usual university quality assurance procedures. Providers have admirably attempted to strongly connect the development of subject knowledge and pedagogical knowledge in at least some assignments. In some instances this creates challenges in terms of accreditation given that the mathematics studied is at GCSE/A level whilst accreditation is of Mathematics Education at H/M level.

Providers have addressed this challenge in different ways. For example, in one assignment a necessary condition for passing the assignment is demonstrating fluency in an area(s) of mathematics but it is the ability to reflect on one's learning (and similar matters) that is judged against H/M level learning outcomes. Here on the evidence of presentations seen, the assignments allow for learning to be evidenced at either H or M level. At another provider a weakness in guidance and clarity about learning outcomes meant that it is less clear that work submitted and accredited at Masters level is of a comparable standard to other M level work. We believe that it is important that providers share examples of their practice at the end of their first assessment cycle to ensure consistency in the validity of the awards offered.

Participants reported that all providers are open to dialogue about course issues and thus we can infer that informal means to improve course quality are in place. In one case a provider has flexibly adapted a course structure to take into account the changes in funding arrangements for teacher release, the geographical spread of participants and participants' own preferences. Concerns raised by participants on one course about information on assessment earlier in the year have been addressed by the relevant provider. Providers have conducted thorough and rigorous self-evaluation of courses and assessment arrangement and this has led to changes in course design for next year.

We have provided each institution with an individual report as part of our interim reporting. These have been discussed with providers during visits for the purposes of transparency, communication and course self-review. Where comparisons between providers are made in the reports it is to support provider self-evaluation and quality assurance and for the purposes of discussing emerging issues.

One such point for discussion is related to attendance on courses and accreditation. There are instances of participants attending far fewer days than some of their colleagues. However these teachers have equal opportunity to be awarded the credits at H/M level by doing the assignments which do not in themselves rely on a high level of attendance. As we have discussed earlier, the assignments do not necessarily cover the whole of the course content. This raises a question of how quality/standard of learning can be assured across all course aims and the need for documenting progress in all areas as previously identified.

9. Issues for consideration

9.1 For providers

9.1.1 To consider the examples of good practice cited from their own and others' courses outlined in this report for continuation or incorporation for 2008/09, including:

- Early contact between tutors and potential participants on application to the courses.
- Briefing documents and/or direct contact with schools about the course.
- Requirement on schools to nominate school based mentors.
- Integration of participants into the wider mathematics education community.
- Facilitating visits between participants to each others' schools.
- The opportunities offered by 'enrichment' activities such as HE sponsored events and other mathematics education events for integration into the course structure, e.g. ATM/MA conference.
- Use of existing recognised high quality training materials such as 'Improving Learning in Mathematics' and the NCETM self-evaluation tool.
- The effective use of formative assessment and feedback.
- Teaching sessions that provide overall an appropriate balance of subject and subject pedagogical knowledge.
- The modelling by tutors of effective classroom practice.
- The contribution of experienced and skilled local mathematics teachers to courses.
- The variety and quality of teaching materials provided to participants.
- Teaching and learning strategies that enhance peer learning and the development of learning communities.
- Regular setting and marking of questions, possibly by peers, related to subject knowledge covered in taught sessions.
- Blocks at the start of the course that help to establish the learning community
- Regular tutorials to discuss progress on the course.

All courses have examples of good practice in particular areas and we believe that providers can learn much by sharing their experiences and practices with each other to help put into operation the suggestions that we have indicated in summary in this report.

9.1.2 To consider ways to enhance the support given to teachers in schools by tutors particularly for those in less supportive circumstances.

9.1.3 It is current practice with some topics on all three courses for concepts to be explored in depth both within the range of the 11-18 curriculum and beyond. Building on this with a focus on core concepts in mathematics may provide opportunities for greater depth (this may mean reducing the extent of content coverage in some cases).

9.1.4 To offer a range of accreditation routes including both M level and H level.

9.1.5 To review assessment tasks with respect to the issue of assessment of GCSE and A level mathematics and of H and M level mathematics education and share practice between providers to ensure consistency in the validity of awards particularly in relation to M level.

9.1.6 To consider ways of spreading the assessment workload more evenly during the year or for some assessment work to continue after the taught course ends.

9.1.7 To consider formalising the initiative by some participants to arrange visits to each other. Whereas ITT students will visit and experience at least two different mathematics departments before becoming NQT, non-specialists miss out on this. One way of providing this experience is for peer visits of this sort. More ambitiously we wonder if it is possible for non-specialists, particularly those working in isolation, to do short work exchanges of 1 to 5 days with other participants or perhaps more experienced teachers such as leading teachers and ASTs or teachers working in outstanding departments.

9.1.8 To consider ways to improve the documentation of initial needs analysis and subsequent progress against course aims, in particular breadth of subject knowledge development, and negotiated individual professional development aims. As a benchmark this documenting process should allow for the production of an end of course profile, or other record, that provides details of areas that have developed alongside identification of future development needs.

9.1.9 To consider ways to encourage participants to make better use of the additional 10 days support available for individual study. This might be through individual action planning process that specifies what the 10 days will be used for.

They might be supported by offering a menu based on the type of activities that providers have offered and that participants have found effective, such as:

- Visits to other participants schools.
- Visits to mathematics specialist schools and/or lead departments.
- ATM/MA/NCETM events.
- Participation in other LEA or commercial training and CPD related to specific interests and/or needs.
- Time to attend the provider's site to make use of learning resources (specified study time out of school). Perhaps linking this to tutorials.
- Time out of school to work on specific tasks such as assessment tasks.

9.2 For the TDA

9.2.1 To consider the relationship between funding arrangements and issues of school based support by tutors and others.

We note the Gatsby funded mentoring project to support the SASP participants. We believe that if similar support is not possible for mathematics teachers other forms of support should be explored. Possibilities discussed with providers and participants include: additional funding to providers to allow for more visits to participants in their schools by tutors without detriment to the taught aspects of the programme (or in the case of the provider who was able to carry out school visits this year, to be able to continue to visit but be able to increase the number of teaching sessions); possible co-ordination of support from local ASTs, leading teachers, strategy advisors/consultants; involvement of regional NCETM co-ordinators.

9.2.2 To reconsider the aims of the courses in terms of the relationship between subject knowledge and subject pedagogical knowledge and the assessment and accreditation of this. Discussion about this might be usefully had with the original steering group or the Advisory Committee on Mathematics Education.

9.2.3 To re-consider the appropriateness of length of the course. Many participants referred to the intensive nature of the courses and the workload involved. Some remarked that time to prepare to be away from school was also a considerable burden. It may be that a course with a similar level of commitment in terms of release from school but over a longer period would address this issue.

9.2.4 To consider extending funding for the course or for a follow up course to allow for further development of the teachers' subject knowledge and professional knowledge to become fully competent to support higher level GCSE for those who do not achieve this by the end of the initial programme and wish to do so.

9.2.5 To consider the relationship between the financial incentive and course completion and certification. Fuller documentation of individual progress could support a more complex model of the link between course completion and financial incentive, one that assesses progress not only in terms of H level and M level accreditation but also progress in term of overall course aims.

9.2.6 To encourage providers in the national roll out to offer flexible accreditation options in terms of H or M level. To evidence that accreditation is demonstrably robust in terms of validity and comparability of credit awarded particularly if only M level is offered and where this is related to reflection on personal subject knowledge development.

9.2.7 To encourage providers in the national roll out to ensure that staffing is resilient to changes in roles or unanticipated factors

9.3 For the TDA and providers

9.3.1 To consider possible ways for participants, particularly those who lack adequate support for development in their professional circumstances, to be able to observe and/or be observed by experienced and skilled mathematics teachers.

9.3.2 To consider ways to overcome barriers to school visits by provider tutors, the most effective balance between use of time to visit in school and taught sessions and resource implications for school visits.

9.3.3 To be aware of the need to consider in the future how the MDPT courses may be connected into the new Masters in Teaching and Learning courses.

9.3.4 To consider making explicit an additional course aim of enabling participants to become independent and confident learners of mathematics to further enhance their subject knowledge after the end of the course.

9.3.5 To consider working with the NCETM to evaluate how the on-line subject knowledge and professional knowledge materials might be best integrated into the courses.

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Annexe 1 - Details of course structure and accreditation

In this section we have included details of the three courses and have diverted from the practice in the rest of the report in terms of identifying particular providers by name. We have done so because we believe that there is interest amongst providers about the different courses models adopted and so reporting in this way may help to facilitated discussion between them. Structures in 2008/09 are similar. Brighton and Wolverhampton both commenced with an intensive induction and taught sessions of 4/5 days. A distinctive feature of Brighton's course was that some teaching sessions are located in partner schools and run by local teachers. The host schools were recognised as having "excellent maths teaching" (as described by provider). This was highlighted by participants as being one of the strongest features of the course.

The course structure at Brighton comprised a mixture of full days and twilight sessions. In response to participant feedback proposed Saturday sessions were replaced with longer weekday/twilight sessions. We note that the course structures were designed before funding was announced for release of teachers from schools.

Wolverhampton follows an intensive start with evenly spaced single days. Liverpool Hope has adopted a programme of 2 day blocks with a residential experience early in the course and has timed these blocks to coincide with and thus encourage involvement in events of the local mathematics community.

Participants have conflicting views on the issue of using the same day of the week. This arrangement means that teachers will released from the same classes at the same time whenever attending the course. However, such a regular commitment has enabled some schools to make arrangements in advance to cover teaching, for example at least one school was able to obtain additional supply cover from an experienced mathematics teacher on Fridays over the whole year. It also allowed some schools to plan timetables to minimise the cover needed. Unfortunately, this can mean that teachers are partially attending in PPA time or personal time (for those on fractional contracts) rather than in time released through TDA cover funds. In response to participant comment on this issue, for 2008/09 Brighton will be varying the day of the week on which sessions will run.

The two day structure at Liverpool was widely supported by teachers there as two days allowed for greater immersion in professional learning. It has caused problems for a few participants in terms of travel (overnight accommodation was arranged) or where the participant felt it was impossible to be released on one of the days.

There is no strong evidence that any one structure is more or less suitable in terms of developing subject knowledge or supporting participant participation. Each of the arrangements causes difficulties for some participants. For example some participants are travelling (unanticipated) long distances and have found it difficult to attend twilight sessions.

School and college leaders emphasised the importance of payment to support teacher release. However we noted that in practice some schools have not applied for the releasing funding that was available. There does not appear to be one single reason for this, though at least one school appeared to be unclear about the way to claim.

The three providers have chosen different combinations of sessions taught by providers, by partners, enrichment activities provided by the wider mathematics education community and support through school visits.

The Brighton course programmed the equivalent of 25 day sessions, offered on site at the University or in partner schools or tutorial support. Brighton expected to offer participants support in schools through tutor visits. This was not possible this year. For 2008/09 the required resource to enable these visits to be built into the programme has been allocated in advance. In 07/08 Brighton also offered support for seven teachers to attend the ATM/MA Easter conference

At Liverpool 20 days were taught by providers. In addition, participants were encouraged to take part in an extensive programme of enrichment activities such as local mathematics association events, and, like Brighton, the ATM/MA conference. In addition all participants were visited by a tutor in school, at least once with some visited twice. These visits included lesson observation, feedback and tutorial support. Participants were very positive about the value of the visits and the effectiveness of the support and feedback offered.

Wolverhampton offered 30 days of taught sessions. Participants have appreciated the regularity of contact with each other. With tutor encouragement and support the participant group have organised exchange visits to each others schools/colleges and to schools where there is exemplary practice. Tutor visits are planned in autumn 2008 to support the graduating cohorts' curriculum projects.

Accreditation

Liverpool Hope is offering accreditation at only H level (Level 6), with the intention of offering further extension modules at M/L7 level for participants who wish to continue. All 19 participants are completing this.

At Brighton all participants submit an assessment for 20 credits at H level, for the remaining 40 credits they can either submit at Masters level or at H level. Of the 11 participants, 6 have submitted at H level and the remaining participants at M level.

At Wolverhampton, accreditation is only available at M level; this being a combination of adapted existing module and a module designed specifically for the course. Here 3 out of the 9 finishing participants have decided not to submit assignments for credit (and so are not eligible for the financial incentive).

In summary one provider is offering accreditation at only Higher (level 6) level. One provider is offering the accreditation at only Masters (level 7) level. The other provider has offered participants the choice of level of accreditation. In order to do this the provider has specified each task at both levels with related assessment criteria.

Annexe 2 Summary Survey responses

MDPT - All providers

Feedback from participant teachers autumn 2007

		Strongly Agree	Agree	Neutral	Disagree	Strongly disagree	Non-responses
1	The type of questions asked in the initial needs analysis at the start of the course were appropriate	12	15	5	0	0	1
2	The structure (pattern of days) of the programme I am following suits me	14	14	3	2	0	0
3	I have identified my individual learning development needs in the subject	8	25	0	0	0	0
4	My school/college is providing a good level of support in helping me to develop subject and subject pedagogical knowledge	6	18	9	0	1	0
5	The expected work load for the course seems about right	6	17	6	3	0	0
6	The learning styles used during taught sessions suit my needs	5	25	1	0	0	1
7	Since beginning the course I have already made a good start at improving my subject and subject pedagogical knowledge	11	18	4	0	0	2
8	I think it important that the programme allows me to gain credit for my learning	18	10	5	0	0	0
9	The cohort size of my group is about right	21	11	0	0	0	0
10	I am able to allocate sufficient personal private study time to support the course	1	13	10	8	1	0

Annex 3 - Summary of Participant Data and Sample profiles

Summary of participant data

	Brighton	Liverpool	U of W	Totals
Number of participants	13	18	12	43
ITT Specialism				
PE	6	4	3	13
History	2	2	0	4
English	2	0	0	2
DT	1	1	0	2
Music	1	0	0	1
Science	1	1	2	4
Maths (primary or middle school)	0	3	2	5
Geography	0	2	0	2
ICT	0	1	0	1
Economic/Business	0	1	3	4
Art and Design	0	0	1	1
Engineering	0	0	1	1
Cert of Ed	0	2	0	2
Mean Years of Experience Teaching mathematics ⁴				
	10.7	7.7	12.7	10.0
Highest Qualification in Mathematics				

⁴ Note that this data is taken from provider report and some of the participants have extensive experience teaching mathematics in SEN, Primary or Middle School contexts. The mean figure does not represent the length of time teaching Mathematics in Secondary schools which from discussion is lower than these figures might indicate.

	Brighton	Liverpool	U of W	Totals
Certificate in Education	0	0	1	1
Level 4	0	1	0	1
A-level/level 3	1	5	6	12
HNC/BTEC	0	1	0	1
City Guilds	0	1	0	1
GCSE/CSE/O-level	12	9	4	25
Proportion of time table teaching mathematics				
81-100		10	3	13
61-80		2	2	4
41-60		3	5	8
21-40		0	1	1
0-20		1	0	1
How did you find out about the course				
Provider Publicity	9	2	12	23
Website/internet	3	5	1	9
LA or Maths Adviser	0	3	0	3
Colleague recommendation	1	8	0	9

*Mathematics Development Programme for Teachers (Pilots) External Evaluation for TDA
End of Year 1 Report*

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