

Evaluation of the NCETM Primary Mathematics Host Schools Project 2012-13

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Glossary of acronyms and explanation of key terms¹

AfL: Assessment for learning i.e. formative assessment

APP: Assessing Pupils' Progress, guidance produced to enable schools to apply Assessment for Learning (AfL) consistently across the curriculum

ARE: Age related expectations

AST: Advanced Skills Teacher

C1, C2, C3, C4: Case Study 1 -4

C1H1, C2H1, C2H2 etc: Case Study 1, Host School 1; Case Study 2, Host School1; Case Study 2, Host School 2 , etc. (note that in some project networks there was more than one school designated as a Host School)

C1V1, C1V2, C2V1 etc.: Case Study 1, Visiting School 1; Case Study 1, Visiting School 2; Case Study 2, Visiting School 1 etc.

CEIR: Centre for Education and Inclusion Research

CPD: Continuing Professional Development

CTP: Collaborative Teaching Project. This is an initiative funded by the NCETM to support schools in undertaking collaborative work across several schools with the support of an expert outsider

HLTA: Higher Level Teaching Assistant

Host School: A school which acted in role of group leader of a network group

INSET: In-service training

LA: Local Authority

Lesson Study: a Japanese model for professional development that involves collaboratively planning a lesson with colleagues, with one of the group teaching it, and with the others observing. The group consider the children's learning and responses to the study lesson. The group then go on to adapt the lesson plan and reteach it to another group of children, again with observers. The cycle ends with a final discussion about what the group has learnt from the study before embarking on a new cycle.

MaST: Mathematics Specialist Teachers. A course for primary teachers at Masters level

PD: Professional Development

PMHSP: Primary Mathematics Host Schools Project

PMHSPL: Primary Mathematics Host Schools Project Lead

PMHSPA: Primary Mathematics Host Schools Project Administrator, supporter of the project dealing with administrative and financial aspects of the initiative

Pupil conferencing: form of teacher inquiry focused on close study of pupil activity and interviewing pupils about their mathematical understanding

TA: Teaching Assistant

Visiting School: Participating school which was part of a network group

¹ For consistency the above glossary is based on the descriptions used in the report of the Primary Mathematics Host Schools Project Leader with some additions.

1. Executive summary

1.1 The project and the evaluation

The NCETM Primary Mathematics Host Schools Project (PMHSP) aimed to promulgate teaching for arithmetic proficiency based on fluency and understanding in Y3 and Y4, through school-led professional development. This innovative project was distinctive from previous NCETM instigated/supported teacher-led professional development networks. Distinguishing features were the requirement on networks to focus on a specific aspect of the curriculum and two primary years, as well as the approach of identifying 'Host' and 'Visiting' schools.

The project was evaluated using a mixed method approach. The main data collection was through 2 surveys (response rates $n=212/212$, $n=185/212$) and 4 case studies. The evaluation considered the extent to which the project aims and objectives were met and against criteria of reach, quality, impact, capacity and capability building and sustainability.

1.2 PMHSP Reach

The 29 PMHSP networks were led by 29 Host Schools that were identified as having the potential to be centres of excellence and with the capability to lead professional development for other schools. The Host Schools recruited and led networks of Visiting Schools that aimed to improve arithmetic proficiency in Y3 and Y4 classes. A total of 157 Visiting Schools were funded with a further 15 unfunded schools registered with the NCETM, in addition there were a small number of other schools involved in some networks that were not registered with the NCETM. The project involved 212 schools at some stage in the project as indicated by the survey return, of which 208 were Primary Schools. The number of teachers involved is estimated to be approximately 500 Y3 / Y4 teachers and 500 other practitioners, giving a total of 1000 practitioners. Host Schools were paid £500 per Visiting School that was intended to be shared with the Visiting School.

The schools involved in the project represent the diversity of English schools including a significant number facing challenges in terms of pupil demographics. The Host Schools were less successful in targeting schools with lower than National Average attainment in terms of end of KS2 results in mathematics. The schools were geographically dispersed.

1.3 Project focus

The focus of the school-led professional development was on the four arithmetical operations. In addition, an important theme in many networks was the application of arithmetic. Schools adopted a variety of professional development approaches, with the majority of participants experiencing forms of collaborative professional development, such as Lesson Study. These have been shown in other contexts to lead to significant and sustainable teacher learning and changes in practice.

In addition, in many networks, participants engaged in a sufficient amount of CPD to provide the potential to significantly change teacher behaviour. However, there was variability between and within networks. There was a positive correlation between network size and number of CPD hours. Those networks using Lesson Study also tended to engage in more CPD activity. Based on survey data, a minimum of 8400 hours of CPD occurred in total, and possibly more than this.

1.4 Quality and outcomes

The evidence indicates that NCETM provided high quality support including tailored on-site CPD and support activities; this was valued by the large majority of participants. In addition the NCETM supported the project with two well-regarded national project events. Overall, a large majority of participants considered the project to be successful or very successful against a range of criteria.

Most surveyed participants in the project identified positive impacts on pupil learning and relationship to arithmetic and 72% believed that initial evidence suggested that pupil attainment had been increased due to involvement in the project. Teachers leading projects in each school identified a range of learning as outcomes of the project related to their own teaching of arithmetic for fluency and understanding and parallel learning for other practitioners. Some wider impacts on schools occurred. In total 77% of respondents, indicated that either they were more able to develop children's fluency or had greater knowledge of progression in children's understanding or both. An emergent aspect of learning, from projects with different arithmetical foci and using different forms of CPD, was the increased importance for teachers of using a wider variety of representations and models in teaching.

Although the project was not directly focused on developing subject and professional development leadership capacity and capability, it was also successful in these areas. A number of examples of this are given in the case studies. A significant impact in terms of capacity building was in the development of collaborative cultures in schools and networks between schools. Some 79% of surveyed participants indicated that it was likely or very likely that their networks would continue to work together in the future, with many having already identified plans to do so. Thus, the project also appears to have led to sustainable outcomes.

Two thirds of the participants considered the payment to schools to be important when asked. However, in one network 10 schools participated without funding. Overall, comparing with other CPD the PMHSP appears to represent value for money.

1.5 Factors that supported positive outcomes

Of the four case studies undertaken, three focused on highly successful networks. However the fourth, whilst meeting the project aims, did not demonstrate the same level of CPD engagement as the others. Analysis of the case studies indicates that the following are important enabling factors in highly successful networks:

- passionate leadership by mathematics subject leaders;
- shared leadership;
- building on existing networks;
- networks of sufficient size to develop and maintain momentum;
- professional development activities that involve teacher enquiry into pupil learning such as lesson study and pupil conferencing;
- the involvement of more than one practitioner in each collaborating school;
- activities to focus PD between formal sessions;
- a clear development plan sustained over a number of months;
- access to external expertise;
- evidence based enquiry during on research and/or academic study;
- and support of school leadership.

1.6 Recommendations

Recommendation 1: The NCETM and DfE should consider repeating the PMHSP for other aspects of Primary Mathematics and/or year groups and using it as a model for secondary professional development.

Recommendation 2: the positive design features of this project were school networks led by subject leaders; nationally linked networks; a common specific focus across the networks; encouragement to engage in high quality forms of professional development; and external support by a highly experienced and proficient national expert. These should be replicated in future similar projects.

Recommendation 3: the NCETM should review the classification of 'Host' and 'Visiting' Schools in future similar projects and consider instead terms such as Lead and Collaborating School or similar terms.

Recommendation 4: the DfE and NCETM should allow for a longer timescale for recruitment of Host and Visiting schools.²

Recommendation 5: the NCETM should provide greater guidance and support to Host Schools and, in other contexts, other professional development leaders, about the importance of, targeting, and ways to target, underperforming schools for involvement. Guidance for applicants should make the priority of supporting underperforming schools clear to applicants.

Recommendation 6: in future similar projects the NCETM should specify a minimum of network size of six Visiting Schools per Host school as larger networks tended to be more successful and have greater reach.

Recommendation 7: in future similar projects, provide Host School applicants with a number of successful models drawn from the Case Studies in this project and from other NCETM projects, that encourage participation by more than one person from each school involved.

Recommendation 8: prioritise applications using those forms of CPD most likely to lead to favourable outcomes such as Lesson Study and teacher enquiry into learning such as pupil conferencing. Guidance for applications should make these priorities clear to applicants.

Recommendation 9: support collaboration between leaders of primary networks, for example through joint leadership or networks running in parallel.

Recommendation 10: extend the length of projects as this is likely to lead to more positive outcomes from the professional development support. Ideally, recruitment and contracting would happen over one term and project activities would then take place over a full school year.

Recommendation 11: for future similar projects extend the time for evaluation by schools of projects to allow them to use end of year pupil performance data.

² This will also support other recommendations made in relation to improving effectiveness and quality, for example, by being able to be more selective of applicants.

Recommendation 12: consider using reliable specific measures of impacts on pupil learning for projects where the focus is specific enough to allow this, selecting those measures that are likely to be a potential source of professional development themselves.

Recommendation 13: gather data on participating schools that uses national measures of socio-economic need and school characteristics either from schools or from DfE sources.

1.7 Conclusion

The Primary Mathematics Host Schools Project was a new initiative by the NCETM. Whilst there are some lessons to be learned for the future, these should not detract from the evaluation finding that it was, for the most part, successful in meeting the programme aims and objectives. It provided participants with high quality professional development that had significant reach and enhanced the capacity within and across schools for school-led professional development. There are indications that in many networks and schools improvement will be sustainable. Overall, the project appears to have provided value for money in comparison with alternative CPD possibilities and it has contributed to both improvements in mathematics teaching and the aim of school-led system-wide improvement.

2. Introduction

The Primary Mathematics Host Schools Project (PMHSP), conducted by the National Centre for Excellence in the Teaching of Mathematics (NCETM) aimed to promulgate the importance of arithmetic proficiency in primary schools (see [Annexe A](#)). The particular focus was on teaching of arithmetic to Y3 and Y4 pupils. This arose from an identification of a progress 'dip' in these years.

The aim and objectives of the project were as follows.

Aim: To promulgate the importance of arithmetic proficiency and the effective teaching of calculation as identified in the NCETM Primary Lead Programme in primary schools.

Objectives

- To identify 20-30 primary schools as centres of excellence in teaching calculation in line with the primary narrative ([Annexe A](#)), achieving a geographical spread across England.
- To facilitate, through these centres of excellence, a minimum of 150 schools (but targeting 200 schools) that are underperforming in mathematics in years 3 and 4, in particular in arithmetic proficiency and teaching calculation, in developing their approach to teaching calculation across the whole school and in order to improve pupils' performance.
- To evaluate the effectiveness of the primary mathematics host school initiative overall
- The PMHSP involved funding primary schools identified as centres of excellence (described as 'Host Schools') to work with a number of other schools ('Visiting Schools') to improve the teaching of arithmetic.

This innovative project was distinctive from previous initiatives instigated by the NCETM that involved teacher led professional development networks in its focus on a specific aspect of the curriculum, a focus on two specific primary years and a national network formed around these foci.

Sheffield Hallam University's Centre for Education and Inclusion Research (CEIR) was appointed to conduct an external evaluation of the project as part of, and to inform, a wider evaluation of the NCETM's current programme. A mixed methods approach was used involving analysis of a survey already undertaken by the NCETM, a follow up survey, documentary analysis, and four case studies involving site visits and interviews.

After describing the project and providing further details of the evaluation process, the main body of the report is organised into, firstly, an analysis of data from the surveys and other documents and, secondly, four Case Study reports. Both the survey analysis and Case Study reports are organised by the following categories that are drawn from the aims of the wider evaluation of the NCETM programme, namely: reach; effectiveness (quality and impact), capacity and capability building; and sustainability. Following this, a 'value for money' analysis is provided, lessons for future projects considered and recommendations are made.

3. Description of the project

3.1 Outline

A total of 29 networks of schools were established. Of these, 27 networks were led by a single Host School and in two networks responsibility was shared between two or three schools, giving a total of 32 officially recognised Host Schools. However, in a number of other networks leadership responsibility was shared by the school initially designated as the Host School³. A total of 176 of visiting schools participated in the networks of which 157 were funded, with an additional 19 joining a network without funding (see Case Study 1). In addition a number of secondary schools or early years settings participated in some of the networks giving a total of 212 participating organisations.

Host Schools were paid £500 for each Visiting School that they worked with. Of this bursary, a minimum of £200 was passed on to the Visiting Schools. The exact amount was determined by the Host Schools.

3.2 Timeline

The project was delivered in a relatively short timescale, as indicated in Table 3.1 below.

Table 3.1 Timeline of the project

Month	Activity
June 2012	Recruitment of the Primary Project Host Lead and Primary Project Administrator.
July/August 2012	Project planning.
September/October 2012	Identification and recruitment of Host Schools. Supporting Host Schools to identify visiting schools.
November 2012	Launch event. Base line survey. Recruitment of visiting schools. Most networks formed.
December 2012	Development of Host school plans. Professional development activities begin. PMHSPL visits to networks begin. All networks now established.
January 2013	Network activities. PMHSPL visits.
February 2013	Network activities. Appointment of external evaluator as part of the NCETM programme evaluation. PMHSPL visits.
March 2013	Network activities. Evaluation survey. Evaluation event. PMHSPL visits.
April 2013	Project network activities (some networks continue their work). Project end date 30 th April.

³ For the purpose of the figures given in the report only two networks are considered to be jointly hosted as this was the initial arrangement with the NCETM.

3.3 Recruitment of schools

Host and visiting schools were recruited both by direct approaches and from an advert on the NCETM web portal (see [Annexe B](#)).

3.3.1 Host schools

The project team, with support from the DfE, identified approximately 50 schools that had made significant and sustained improvements in progress over the last five years. These schools were invited to apply to be a Host School and most Host Schools were recruited to the project in this way.

The criteria for the selection of the Host Schools, as expressed by the PMHSPL, were that they:

- had a story to tell about improving and sustaining attainment in mathematics over the last five years;
- could demonstrate an interest in teaching arithmetic;
- were able to exhibit an approach to teaching calculation that was in line with government policies and priorities;
- were able to articulate a story about working, or wanting to work, with other schools in their neighbourhood to develop practice;
- had calculation policies in place or well into development;
- were experienced in supporting their own staff to develop both their understanding of mathematics and their knowledge of ways of teaching it to children;
- had an identified 'mathematics champion' who led their involvement on the project;
- were able to produce examples of excellent practice in the teaching mathematics.

The schools were also selected to offer a geographical spread across England.

In two cases, schools in the same area applied or were identified and so were selected as joint Host Schools. Later, during the project, the nature of the joint collaboration in networks meant that another network of two visiting schools acted as hosts working closely with an original host school. Another notable arrangement was in one network, led by an AST, where a second AST in a visiting school contributed informal leadership to the project.

3.3.2 Visiting schools

The Host Schools worked with the Project Lead and Project Administrator to identify an additional 177 Visiting Schools.

3.4 Overview of the networks

The size of networks varied as is shown in the table below. In addition to the 208 Primary Schools a further four secondary and/or early years centres were involved in some of the networks.

Table 3.2 Size of networks*

Number of schools in the networks ⁴	Frequency
4	2
5	10
6	5
7	2
8	4
9	2
10	2
15	1
21 ⁵	1

*mode - 5, median - 6, mean - 7.2

Professional development activities of the networks were organised and led by the host schools in consultation with the Primary Mathematics Host Schools Project Lead. They broadly followed the anticipated forms of professional development given in the project contract between the NCETM and the DfE, namely:

- organising visits for mathematics subject leaders, and others who influence the curriculum, from other schools to discuss approaches;
- sharing resources and documentation around arithmetic proficiency (e.g. calculation policy and strategy);
- hosting CPD events, seminars;
- engaging in lesson study-type activity, involving peer observation and review of lessons, analysis of student work, etc;
- demonstration lessons by host school in host or visitor school

Further details about professional development activities and the frequency with which different activities occurred is given in [Section 6.2](#).

3.5 NCETM support

3.5.1 Primary Mathematics Host Schools Project Lead role

The Primary Mathematics Host Schools Project Lead (PMHSPL) was responsible for the overall professional development and mathematics education leadership. This included:

⁴ The network size is the total of host and visiting schools in the network. For most networks the number of visiting schools is one less than the network size. The exception to this are two networks one of these had 2 hosts and 11 visiting schools, giving a size of 13, and the other 2 hosts and 8 visiting schools giving a network size of 10

⁵ This network consisted of 10 funded visiting schools and 10 unfunded visiting schools some of which were not registered with the NCETM but were identified during a case study visit.

- working with the NCETM, DfE and OFSTED to identify and invite Host Schools;
- reviewing and advising on Host School Plans and supporting them in recruiting visiting schools and providing on going advice;
- devising the baseline survey;
- designing and leading the launch and evaluation events;
- visiting each network group and offering a range of custom support (see [Section, 6.4.1](#) and also [Annexe C](#));
- supporting the external evaluation including the design of the evaluation survey and identification of potential networks for case studies;
- writing a report on the project;

3.5.2 Primary Mathematics Host Schools Project Administrator

A project administrator provided administrative support to the PMHSPL, the schools and external evaluators.

3.5.3 Launch and evaluation events

A launch event was held in November 2012 that offered workshops and advice on forms of professional development and on arithmetic proficiency strategies. An evaluation event was held in March 2013 with a number of projects sharing outcomes as well as input from others with practice to share.

3.4.4 Web portal and resources

A project site was established with communities for each network.

4. Evaluation methods and activities

4.1 Aims

The evaluation aims agreed with the NCETM were:

1. To evaluate the extent to which the Primary Mathematics Host Schools Project succeeding in fulfilling the project aim and objectives as set out in the extension to the NCETM contract related to this project (see [Section 2](#) above).

2. To consider the following focus areas drawn from the *'Evaluation of the mathematics continuing professional development (CPD) support programme managed by the NCETM for the Department for Education tender document'*, so as to contribute to that evaluation:

- Reach to schools and teachers;
- Effectiveness of the programme (quality and impact);
- Capacity and capability building;
- Sustainability beyond the end of the programme;

4.2 Overview

The evaluation used a mix of methods, documentary analysis, background data collection, survey analysis and Case Study visits.

4.3. Documentary analysis

A range of documents was considered including:

- Project data base;
- DFE/NCETM contract variation document;
- Primary Narrative;
- Documents related to the Launch and Evaluation Events, including evaluations of these events;
- PMHSPL final report including narratives produced by participating schools;
- The NCETM website.

4.4 Background data collection

The following additional activities were undertaken:

- telephone interviews and face to face interview with PMHSPL;
- discussion with NCETM evaluation steering group;
- attendance at 20th March Primary Mathematics Host Schools Project evaluation event.

4.5 Surveys

Two surveys were conducted during the project. The first survey, Survey 1, was designed by the PMHSPL, and provided baseline data on participating schools as well as information to inform project support activities.

The second survey, Survey 2, was designed collaboratively by the evaluation team and the PMHSPL.

The survey was intended to be completed by one person per participating school. This included a number of secondary schools working in some of the networks.

Survey 1 was released on 12th November 2012, Survey 2 on 13th March 2013. Survey 1 received 212 responses⁶, and Survey 2 received 185 responses. The population is unclear, making the exact response rate difficult to establish. However the indications are that there was a relatively high response representing 87-90% of Primary Schools involved.

Note that there are potentially response biases, with the most successful projects conceivably being more likely to complete the survey. Responses varied across networks with, in some cases, all schools in a network completing the second survey and in others less than half the schools (minimum one school out of a network of four) and there being responses from 90% Host Schools. In addition, it should be noted that responses to questions decreased during survey 2, with a minimum response rate of 72% of Host and Visiting school participants on any question. Nevertheless, the two surveys provide a detailed picture of the views of the majority of participating schools.

It is important to note that the timings of completion of Survey 1 survey ranged from December 2012 to February 2013 (with two responses received even later than this), with timing of completion of Survey 2 ranging from March to April 2013. Therefore, for questions where comparison is made directly between Survey 1 and Survey 2, caution is needed due to wide variations in the time between completions of the two surveys for different participants.

Surveys were completed on-line before being processed in specialist quantitative data software and/or spreadsheet software before being analysed.

4.4 Case studies

Case studies were conducted on four networks. Selection of the case studies was discussed with the PMHSPL and was based principally on impressions gained during the PMHSPL visits, applications and network plans submitted to NCETM, and data from Survey 1. Due to timing the data from the second survey was not available to guide selection.

The main criterion was to identify four networks that appeared particularly successful. The rationale was to understand more about enabling factors to inform future similar projects. Thus the cases were not representative, particularly in relation to size. Three case studies involved networks greater than the median size, with one being of the median size (see Table 3.2). One of the larger networks was led by two host schools and ran as two parallel sub-networks. This Case Study was selected to examine the impact of joint leadership. One network, the largest in the project, had grown to include 10 schools not funded by the NCETM in addition to the 10 funded visiting schools. The decision to exclude smaller networks was that it was apparent from the PMHSPL visits that larger networks were at least as successful as smaller ones and consideration was given to the potential of scaling up a similar project.

Although the intention was to focus on four particularly successful networks, the evidence from the Case Study visits and analysis of survey data indicates that only three of the four networks (Case Study 1, 2, and 3) could be described in that way across a full range of criteria. The fourth (Case Study 4), did not involve the same level of activity as the other three,

⁶ Not all of the schools that completed Survey 1 appear to have been registered with the NCETM and it may be that a small number were forwarded the link to the survey by their Host School.

although it clearly had benefits for participants,. However, this difference allowed for clearer identification of common enabling features in Case Studies 1, 2 and 3.

Evaluation activities for each Case Study varied but in all cases involved: a review of survey data related to that network; a visit to the host school and interview with the network project lead; visits to or interviews with one or more visiting schools in each network.

5. Reach

In this section the following aspects of reach are considered: participants, pupils and schools.

5.1 Participants

5.1.1 Practitioners

Survey respondents were asked in each survey to report the number of Y3 and/or Y4 teachers involved in the project in their school. The number of Y3 and Y4 practitioners and others from Survey 1 and Survey 2 is given in Table 5.1 below.

Table 5.1 Number of practitioners reported to be participating in project activities

Survey	Number of schools responding	Y3 & Y4	Others	Total
Survey 1	210	401	402	803
Survey 2	185	487	464	951

The response rate on Survey 2, to this question, was 88% of schools involved. Although there was a small amount of attrition of schools, it is reasonable to extrapolate a total of 500 Y3 and Y4 teachers and 500 others giving a total in the region of 1000 for the cohort as a whole.

The increase in number of participants between Survey 1 and Survey 2 may, in part, be due to a change in question from asking about involvement in the 'network' to asking about numbers who had engaged in professional development activities. However, the case studies and feedback during PMHSPL visits suggests that the number of practitioners involved grew during the project. This is an indication of the project's success.

In addition activities during visits by the Primary Mathematics Host Schools Project lead (see [Section 6.4](#) & [Annexe C](#)), involved a total of 371 teachers in a variety of CPD activities - discussed below in [Section 6.4.1](#)).

5.1.2 Characteristics and roles

In survey 1, information was sought on the characteristics of others involved. Note the categories in Table 5.2 are not exclusive as participants may belong to more than one category.

Table 5.2: Characteristics of participants who were not KS1 or KS2 teachers

Characteristic	Frequency
Early Years Foundation Stage Practitioners	56
Teaching Assistants	230
HLTAS	29

Table 5.2 shows that in many schools the project extended beyond Y3 and Y4 teachers including to those in important roles in supporting arithmetic progression. In addition 61 NQTs were involved.

A significant number of participants had either subject or school leadership roles, as indicated in Table 5.3.

Table 5.3: Leadership roles of participants

Leadership role	Frequency
Advanced Skills Teachers/SLE	8
Lead Practitioners	37
Numeracy Coordinators/Leaders/	189
MaST teachers	64
Headteacher	65
Deputy headteachers	51
National Leaders of Education	5

Thus, the NCETM criterion that the Host School should have appropriate subject leadership was met. In addition, the NCETM encouraged Host schools to ask Visiting Schools to identify a mathematics champion. This also was successful. Further, in 31% of schools a headteacher associated themselves with the network and in 24% a deputy head teacher. In 41% of schools either a deputy or a head teacher or both was or were involved.

5.2 Pupils

In Survey 2, 160 participants reported that a total of 7561 Y3 and Y4 pupil benefited from the project during its duration. On the basis of this sample an estimate of the total number of Y3 and Y4 pupils involved across all networks is approximately 10,000. This does not include pupils in classes of teachers teaching other year groups.

The number of pupils benefiting varied considerably, depending, as would be expected, on the number of teachers participating, as Table 5.4 below shows.

Table 5.4 Grouped frequency of respondents' estimates of number of Y3 and Y4 pupils benefiting from the project, n=160

Number of Y3 & Y4 pupils	Frequency	Percentage ⁷
0-19	43	27
20-39	45	28
40-59	19	12
60-79	24	15
80-99	9	6
100+	20	13
TOTAL	160	100

5.3 Schools

5.3.1 Types of schools

In Survey 1, schools were asked about a range of characteristics. These are self-reported and responses will be connected not only to objective characteristics but also to respondents' subjective beliefs about the relevant characteristics. Further, during the Case Study visits the evaluation team were not able, in all cases, to identify schools' locations with one of the three characteristics - urban, suburban and rural.

Table 5.5: Location of the schools, n=212

Type of location	Frequency	Percentage
Urban	94	44
Suburban	59	28
Rural	59	28
Total	212	100

Table 5.6: Size of participating schools, n=212

Size	Frequency	Percentage
Small	100	47
Medium	87	41
Large	25	12
Total	212	100

⁷ Percentages do not total to 100 due to rounding

In addition to the information presented in Tables 5.5 and 5.6 above, 70% of respondents indicated that in their schools pupils were mainly from White British backgrounds. Further, the schools were geographically spread with all English regions represented although the northern regions were under-represented. Overall, then, whilst not perfectly representing the national picture, schools participating in the project are reflective of the diversity of English primary schools.

5.3.2 Challenges facing schools in the project

In Survey 1, schools were asked to provide information on challenges that they faced.

Table 5.7: level of challenge faced by schools, n=212

Challenge	Above average	Average	Below Average	Total
The number of children for whom English was an additional language	22	14	65	100
The number of children with special educational needs or disabilities	29	45	25	100
The number of children with statements of special educational needs	22	35	43	100
The number of children in the school on free school meals	33	27	40	100

From survey respondents' beliefs about their schools, as indicated in Table 5.7, the project schools reflect the diversity of English primary schools in relation to challenges faced with a possible skew to those in more favourable circumstances.

5.3.3 Pupil attainment

In Survey 2, respondents were asked to provide information on their KS2 level 4 assessments, presented in in Table 5.8 below.

Table 5.8: KS2 attainment in mathematics of participating schools in 2012

Approximate end of Key Stage Two assessment level 4 or higher percentage in mathematics in 2012 for participating schools		
Percentage range	Frequency	Percentage
0-54	0	0
55-59	4	3
60-64	5	4
65-69	4	3
70-74	11	9
75-79	10	8
80-84	22	17
85-89	20	16
90-94	27	21
95-100	25	20
Total	128	100

Note there is a possible response bias as 128 of the participating schools responded. Further, the 31 Host Schools are likely to have attainment levels greater than 90% to be selected and 90% of Hosts Schools completed Survey 2 and are more likely to have completed the whole survey.

Nevertheless, of those that responded, 57% had KS2 attainments higher than the National Key Stage 2 results for mathematics in 2012 of 84%⁸. Allowing for the skewing of the cohort due to the inclusion of Host Schools, it appears that the Visiting Schools were broadly representative in terms of attainment ranges of Primary Schools.

The KS2 attainment does not provide information on Y3 and Y4 performance, and it may be that all Visiting Schools experienced dips in those years. Nevertheless, the attainment data indicates that the project only partially met the objective of supporting those who are "underperforming in mathematics in years 3 and 4".

There are a number of possible reasons for this. Evidence from the case studies, discussed below, indicates that when recruiting Visiting Schools, Host Schools, understandably, invited those they already had relationships with, including those in the same feeder school clusters. Thus means that Visiting Schools are likely to share similar demographics to the Host Schools. In addition, whilst the DfE provided information to inform the choice to Host Schools, similar information was not made available to potential Visiting Schools.

⁸ <https://www.gov.uk/government/news/key-stage-2-test-results-published>

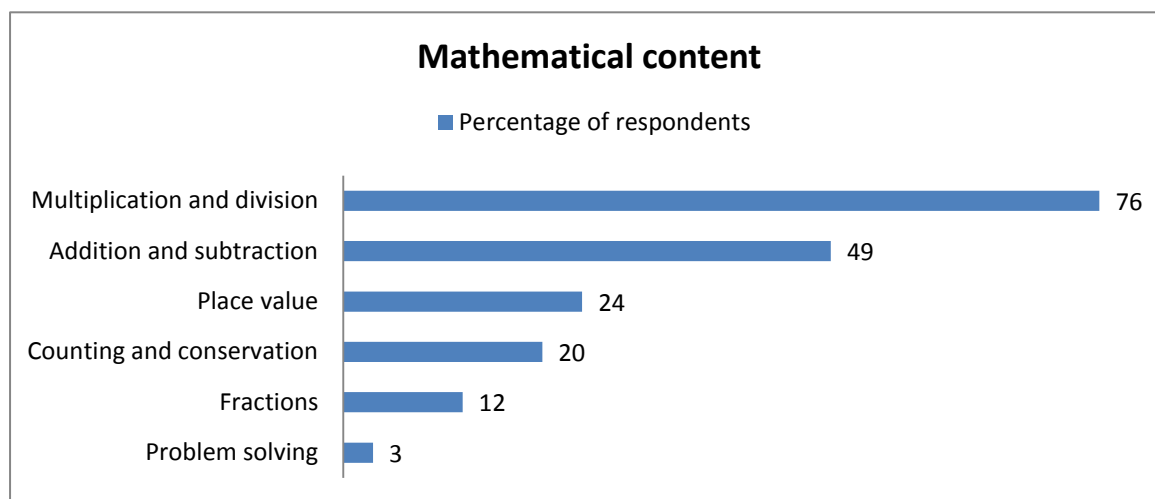
6. Survey data: effectiveness of the programme - quality

In this section the quality of the programme is considered using the following categories: mathematical content; forms of CPD; hours of CPD; quality of NCETM support; and participants' views of overall programme quality.

6.1 Mathematical content

On the basis of responses to questions about the mathematical focus in Survey 1, respondents were asked in Survey 2 a series of closed questions about the mathematical content that their network and/or school focused on (note that respondents could select more than one content option). This is given in the figure below for where the percentage is greater than 3%. Other areas networks worked on were: equivalence; methods of working; number systems; collaborative learning; language; and perimeter.

Figure 6.1 Content focus of networks and schools, n=185

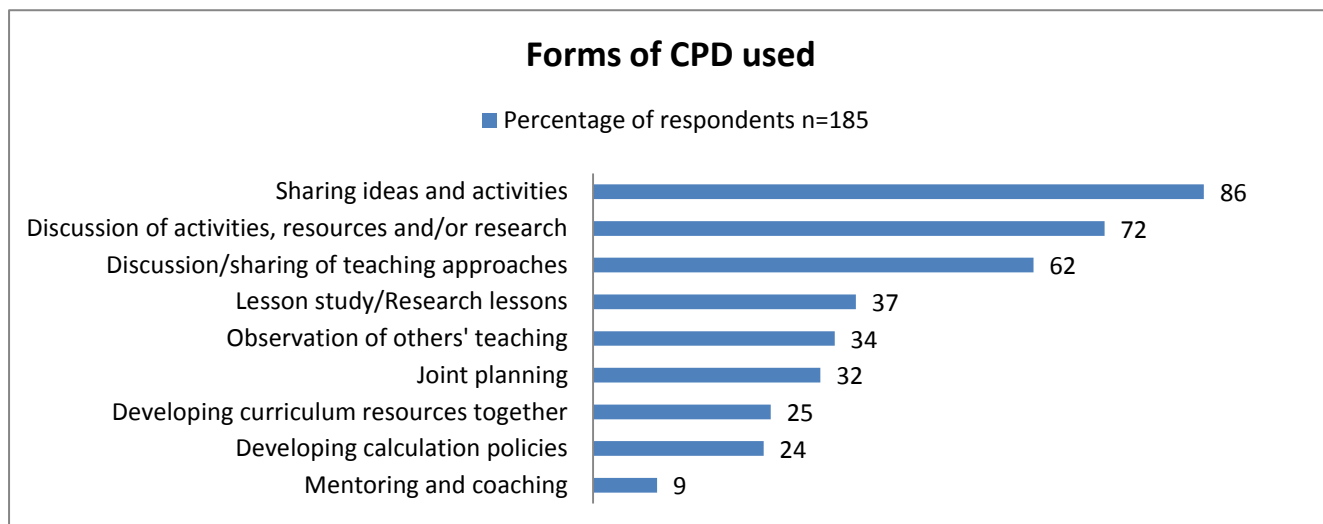


The mathematical content of the projects was in keeping with the overall project aim (see [Section 2](#)) of a focus on arithmetic proficiency and calculation.

6.2 Forms of CPD

Participants were asked, in Survey 2, which forms of CPD they had participated in, with the request to record all that applied.

Figure 6.2 Forms of CPD experienced, n=185



In addition they were asked to list other activities they had participated in. These included: an activity day; secondary primary links; team-teaching and whole staff CPD sessions.

As would be expected from a project of this type, nearly all participants experienced one or more form of CPD that involved sharing or discussion with colleagues, (93% experienced one or other or both). As discussed below, the example of Case Study 1 indicates that this type of activity can be done in a way that has significant possibilities for teacher learning. In Case Study 1 it involved sharing the outcomes of focused enquiry into pupil learning and research evidence.

However, generally, collaboration with a specific purpose is recognised as offering greater potential for significant and sustained professional development⁹. A total of 63% of participants experienced one or more of the following collaborative professional development activities: coaching and mentoring; lesson study; joint planning; and/or developing curriculum resources together. Further, nearly a quarter of respondents were engaged in the development of calculation policies. Thus, the project enabled the majority of participants to engage in forms of CPD that are of potentially high quality.

⁹ Back, J Hirst, C; De Geest, E; Joubert, M and Sutherland, R. (2009). *Final report: researching effective CPD in mathematics education (RECME)*. NCETM

6.3 Hours of CPD

6.3.1 Hours of CPD of Y3 and Y4 practitioners directly involved

Participants were asked about the number of hours of CPD activities that those directly involved engaged in on average. These are given in Table 6.3 below.

Table 6.3: Grouped frequency of CPD hours of practitioners directly involved, n=178

CPD hours	Percentage	Cumulative percentage
0-4	20	20
5 to 9	26	46
10 to 14	26	72
15-19	15	87
20-24	8	95
25+	5	100
TOTAL	100	

The overall average of estimated CPD hours per school is 10.5 hours.

However, for at least some of the participants this is likely to be an underestimate of CPD hours. During Case Study visits, it became apparent that some participants had only counted hours of formal CPD activity, for example, network meetings, in survey responses. They estimated that they spent up to three times as long on more informal related CPD activity that was not reported in the survey.

Meta-analysis of research on teacher professional development¹⁰ suggests that, for long-lasting change, a minimum of 14 hours involvement in any single professional development programme is desirable if the programme aims are to be realised. This is notwithstanding the importance of the nature and quality of the CPD. From Figure 6.3, above, it appears that a minimum of 28% of practitioners (possibly an underestimate) engaged in CPD hours above the minimum indicated by the research literature. It is also likely that those networks that continue to collaborate after the end of project funding will lead to greater engagement in the future.

However, clearly in future projects it would be important to reduce variability and level up the amount of engagement in professional development activities. One simple way to do this would be by increasing the length of projects, as it appears from the Case Study visits that the main limiting factor was the relatively short timescale of the project rather than the amount of funding paid to schools.

¹⁰. Yoon, K. S. et al(2007). *Reviewing the evidence on how teacher professional development affects student achievement* (Issues & Answers Report, REL 2007-No.033). Washington, DC: Department of Education, Institute of Education Sciences, NCEERA

In addition professional development is most effective if it takes place over a significant time span rather than in one off activities¹¹. As indicated by the case studies in **Section 10** below, this was the case in at least some of these projects.

The 88% of practitioners responding to Survey 2 reported 4851 CPD hours, giving an average of 10.5 hours per practitioner. Given this sample of the population we can estimate the total minimum number of CPD hours across the project as 6100.

6.3.2 CPD hours of other practitioners

Respondents were also asked to estimate the average CPD hours of other practitioners involved in the project.

Table 6.4: Grouped frequency of CPD hours of other practitioners, n=144

CPD hours	Percentage	Cumulative percentage
0-4	79	79
5 to 9	15	94
10 to 14	4	98
15-19	1	99
20-24	0	99
25+	1	100
TOTAL	100	

As would be expected the figures are lower for other practitioners involved. The total number of hours reported by respondents for other practitioners was 1794 giving an average of just under 4 hours CPD per person. Extrapolating for the cohort as whole gives an estimate of 2300 hours.

6.3.3 Total CPD hours

The above figures for CPD hours must be treated with some caution, for the following reasons.

1. They are estimates of averages by single respondents who may not be aware of all the activity of colleagues. However, the numbers provided in the survey correspond, in terms of the formal CPD activity, to the information provided in Case Study interviews.
2. Survey 2 was completed before the end of projects by many schools when not all CPD activity had taken place (for example, in Case Study 2 a full day was planned in May).
3. From interviews in the case studies, it was apparent that at least some of the participants responded to this question in terms of hours spent at formal CPD events only. In Case Study one, for example, two practitioners estimated that they spent three hours in additional CPD activities as they did for every hour engaged with formal

¹¹ van Driel, J. et al. (2012). Current trends and missing links in studies on teacher professional development in science education: a review of design features and quality of research. *Studies in Science Education*, 48:2, 129-160.

network activities. This network may not be typical as, this was a network in which specific tasks were particularly encouraged between sessions. Therefore, the same multiplier cannot be automatically applied for all networks. A more modest estimate might be to double the number of hours to account for informal CPD.

4. However, when estimating for the whole cohort based on respondents to Survey 2, the possibility of respondent bias could lead to an overestimation. This is because with those most fully engaged were more likely to respond to the survey question.

These factors notwithstanding, the number of CPD hours across the project can be estimated to be a minimum of 8400 and possibly higher than this given the suggestion in case studies (see below) that informal CPD hours were not always reported and some CPD happened after the survey.

6.3.4 Variability in CPD hours

The number of CPD hours varied in and across networks. For example, in one network of seven schools, the four schools completing Survey 2, reported 12, 12, 3 and 1 hours of average CPD engagement per Y3/ Y4 teacher. In another network, with two out of three schools completing the survey, schools reported 15 and 3 hours CPD hours. Note that in the latter it was the Host School that reported the higher figure. The issue of variation within networks is considered in [Section 9](#).

The table below gives frequencies of the average CPD hours per Y3/Y4 teacher across the different networks.

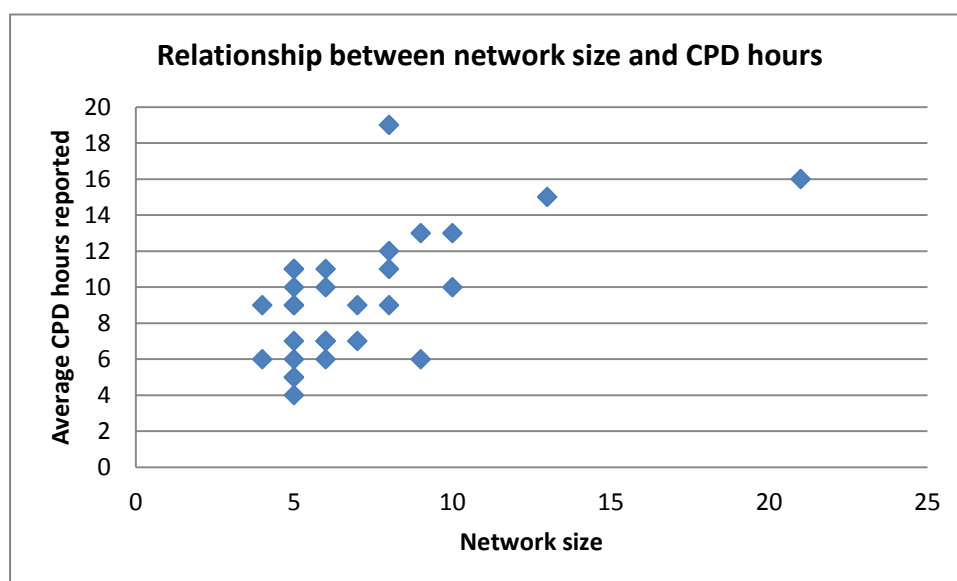
Table 6.5: Reported average number of CPD hours for Y3/Y4 teachers per network

Average number of CPD hours per network	4	5	6	7	9	10	11	12	13	16	15	19
Frequency	1	2	6	4	5	3	3	1	2	1	1	1

6.3.5 Relationship between hours of CPD and size of network

There appears to be a relationship between hours of CPD and network size, with larger networks reporting greater average levels of CPD engagement, as indicated by the figure below. No causal relationship can be inferred from this relationship. A likely explanation is that those Host Schools that had the capacity to establish large networks were also able to engage the Visiting Schools in higher levels of CPD activity, rather than the network size itself leading to more CPD. Nevertheless, this may be an important factor to consider in future similar projects.

Figure 6.3.5: Relationship between network size and CPD hours



6.3.6 Relationship between hours of CPD and type of CPD

Analysis of Survey 2 indicates that those schools engaged in networks using Lesson Study/research lessons as a form of CPD report a higher average of CPD hours at 12.3 for Y3/Y4 practitioners, against 10.5 overall average and 9.4 for those schools not engaged in lesson study. Thus engagement in Lesson Study indicates a likely 25% greater degree of CPD engagement. Again a causal relationship cannot be read into this as it may be that using Lesson Study is a marker of capacity to lead professional development. However, this may be a marker to consider in future projects.

6.4 NCETM support

6.4.1 Primary Mathematics Host Schools Project Lead (PMHSPL) support

The Primary Mathematics Host Schools Project Lead (PMHSPL) visited all 29 networks and offered customised CPD activities to support the work of the networks. In total 371 people engaged in these activities. The table below indicates the range of types of activities involved in these visits (note that more than one activity happened on many of the visits).

Table 6.6: PMHSPL visit activities

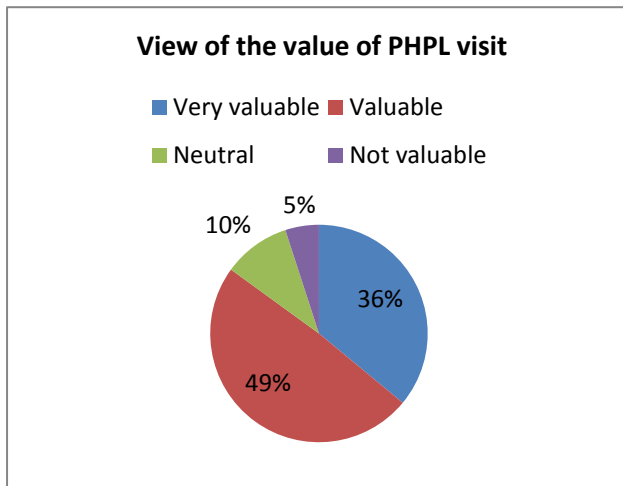
Activity	Frequency
Lesson observation and feedback	2
Demonstration lessons	3
CPD on rich tasks/problem solving/artefacts	3
Lesson observation	6
Discussion of calculation policy	12
CPD on primary arithmetic issues	14

In addition the Primary Mathematics Host Schools Project Lead supported Network Leaders in developing plans, recruiting schools and with advice during the projects. The Case Study visits indicate that this support was valued.

6.4.2 Value of PMHSPL visits to participants

The figure below shows that those responding to the survey found the PMHSPL visits valuable.

Figure 6.6: View of the value of the Project Lead's visit, n=185



6.4.3 National events

All participants who completed evaluations at the final national project event in March 2013 rated it as either useful (25%) or very useful (75%).

6.4.4 Website support

A total of 314 teachers signed up to their own Host Schools Communities on the NCETM website known as the portal. In addition the community set up for the Host Schools to communicate was used by Host school teachers. In Case Study 1 the NCETM portal was used a source for professional development activities.

6.5 Overall view of programme quality

On the basis of an initial analysis based on Survey 1 related to participants' hoped for outcomes and reasons for participating, in Survey 2 respondents were asked the extent to which the project had met these aspirations. This is shown in the table below.

Table 6.7: Success in meeting participants' programme aspirations, percentages, n =155

Programme aspirations	Very successful	Successful	Neutral	Unsuccessful	Total
To collaborate with other teachers in exploring some of the issues that are key in developing fluency and understanding of arithmetic in years 3 and 4	48	43	6	3	100
To learn from other schools who have been successful in teaching arithmetic in years 3 and 4	43	44	9	4	100
To develop a supportive network group that has the potential to support our long term professional as teachers of mathematics	42	39	17	3	100
Develop knowledge about arithmetic	30	56	12	3	100
Learn about using curriculum materials and resources	29	61	6	3	100
Learn about recent developments in teaching arithmetic and research	27	51	18	4	100

Table 6.7 shows a high level of agreement by survey respondents that the project was successful in terms of meeting professional development aims.

Note that success varied across networks and within networks, with Host Schools, unsurprisingly, tending to have a more favourable view of success.

There was a slightly more favourable view of the project success by those engaged in Lesson Study than other project participants; those participating in Lesson Study rated the project more highly against the first three criteria in the table above compared with participants engaging in other forms of CPD.

7. Survey data: effectiveness of the programme - impact

The impacts of the programme are considered in relation to pupils, teachers and school/organisational impacts.

7.1 Pupil impacts

7.1.1 Perceptions of teachers of pupil impacts

Participants were asked about the views of changes in pupils that resulted from the teachers' involvement in the project.

Table 7.1: Pupil impacts, n=160

	Strongly Agree	Agree	Neutral	Disagree
Perceptions of pupils impacts				
My pupils are better at solving word problems using arithmetic operations	11	67	21	11
My pupils enjoy doing arithmetic more	26	58	16	0
My pupils approach solving new problems with more confidence	21	64	15	0
My pupils can recall arithmetic facts such as times tables and number bonds more easily	16	53	31	0
My pupils are more confident in using arithmetic	19	64	16	0

Table 7.1 shows that, across the four issues, the range of those either agreeing or strongly agreeing that there has been a positive change was 68% to 85%. There are no discernible differences across types of networks in terms of immediate pupil impacts.

Additionally, respondents were asked to describe other important impacts on pupils. These were thematically coded and are given below for those where the percentage was greater than 3%.

Table 7.2: Other pupil impacts

Aspect of impact	Percentage
Problem solving ability	5
Using new/different resources	6
Affective, enjoyment, positive attitude	14
Use of different calculation strategies	17
Discussion, thinking, reasoning, use of vocabulary	24
Confidence, resilience, risk taking	24

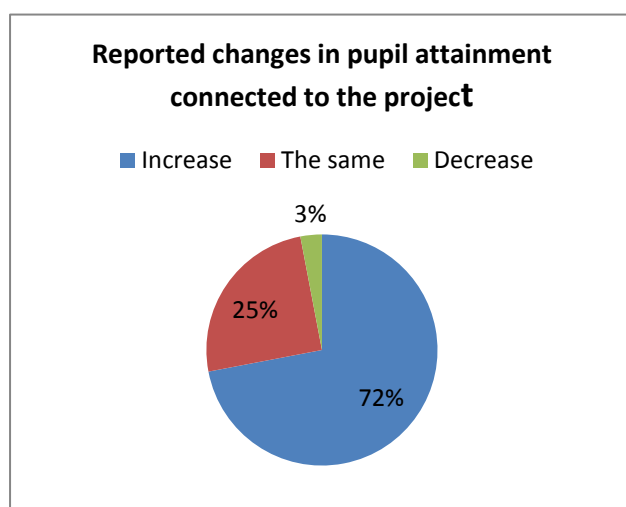
7.1.2 Pupil attainment

As discussed in above in **Section 4**, assessing changes in pupil attainment was difficult given data available and the timescale of the project. Data provided by schools, at the start and at the end of the project, varied considerably in form and with no contextualising information, in most cases, on how data had been derived. In the survey, respondents were asked for information on the amount of progress that pupils in Y3 and Y4 had made in 2011/12 in terms of National Curriculum sub-levels in mathematics, and the amount of progress expected in 2012/13.

Here too, the form of response varied, with some schools providing data of value added measures, others in terms of APP measures, some in absolute National Curriculum levels and others, as requested, in sub-levels. A significant number indicated that they could not disaggregate effects of the project from other school improvement effects and that the project was narrowly focused. Others stated that data was not yet available.

Given all of this, what can be usefully reported with some reliability is the overall perception of each participant as to their beliefs about changes in pupil attainment. As indicated in Figure 7.1, nearly three quarters judged that there had been at least some positive change in pupil attainment. Some 25% reported that there has been no change. Some of these explicitly stated that it was not possible to discern project effects from other influences.

Figure 7.1 Reported changes in pupil attainment connected to the project, n=145



7.2 Teacher impacts

7.2.1 Beliefs, attitudes, knowledge and practices: respondents

Respondents were asked, in Survey 2, about changes in their own beliefs, attitudes, knowledge and practices. They were asked to select up to three statements that reflected impacts on them. Responses are given in Table 7.3 below.

Table 7.3: Changes in attitudes, beliefs and practices n =185 for all statements

Impact	Percentage
I use a wider variety of representations, models and equipment in teaching arithmetic	68
I understand more about the progression of children's understandings of arithmetic concepts	55
I am more able to offer the children opportunities to build on their fluency with arithmetic	47
I understand more about the obstacles to children's understanding of arithmetic	46
I enjoy teaching arithmetic more	25
I am more able to predict children's responses to rich tasks and see the progression in their arithmetic understanding revealed in those responses	24

In addition other issues named by the respondents as impacts on practice related to subject leadership, their own problem solving skills, the use of low threshold/high ceiling tasks and the use of outdoor environments.

In interpreting this data, it should be remembered that many survey respondents were identified in the Host schools as having outstanding practice, and so were beginning from a high base-line in relation to these statements (and this was explicitly stated by one respondent).

The most frequently reported change is in relation to the use of representations, models and equipment. Given that this was only a starting project focus of 3% of networks (see [Section 6.1](#)), this is a significant outcome. It shows that the teachers, in the process of examining their own practice, learning from effective schools, and from the wider evidence base, have come to use a wider variety of representations and models in teaching Y3 and Y4.

The next two most frequently reported changes are closely aligned with the Primary Narrative (see [Annexe A](#)) in that they are concerned with fluency and understanding. In total 77% of respondents to this question, indicated that either they were more able to develop children's fluency or had greater knowledge of progression in children's understanding or both. This indicates that a significant objective of the project had been achieved.

7.2.2 Beliefs, attitudes, knowledge and practices: others involved

Similar outcomes were reported in relation to outcomes for others involved. This is shown in Table 7.4 below.

Table 7.4: Impacts on others involved, n =185

Impact	Percentage
They use a wider variety of representations, models and equipment in teaching arithmetic	69
They understand more about the progression of children's understandings of arithmetic concepts	58
They understand more about the obstacles to children's arithmetic understanding	41
They are more able to offer the children opportunities to build on their fluency with arithmetic	41
They enjoy teaching arithmetic more	23
They are more able to predict children's responses to rich tasks and see the progression in their arithmetic understanding revealed in those responses	16

7.2.3 Arithmetic pedagogy and learning activities

In addition, participants were asked questions, in Survey 1 and in Survey 2 about their beliefs about arithmetic teaching pedagogy and types of learning activities rating 10 statements about this as necessary, important or unimportant (see [Annexe D](#) for details of all responses). These statements taken together represent a varied and rich approach to teaching arithmetic in keeping with the Primary Narrative.

For most of these statements the percentage considering them as unimportant were low, with those considering them important being in the range 61% to 87% on Survey 1. The responses on Survey 2 were similar to those in Survey 1. The one exception to this pattern was the statement 'Pupils should have opportunities to practise doing pages of routine calculations presented in symbolic form'. Here the percentages were, for survey one, necessary - 33%, important 37%, and unimportant 30%, and for survey two, necessary - 41%, important 23%, and unimportant 36%.

The table below gives the changes for each of the ten statements between Survey 1 and Survey 2.

Table 7.5: Changes in beliefs about arithmetic learning practices

	Necessary	Important	Unimportant
Difference in percentage survey 1 to survey 2			
Use of practical apparatus such as Numicon, Cuisenaire rods, Dienes apparatus or multilink cubes, bead strings, empty number lines	-1	1	1
Use of resources that use numbers in symbolic form such as place value cards, 100 square, number tracks, numbered number lines	9	-9	0
Opportunities to practise doing pages of routine calculations presented in symbolic form e.g. $3 + 5 =$, $17 - 9 =$, $6 \times 4 =$	8	-7	-1
Opportunities to tackle 'word problems' such as 'If Jack has 7 grapes and his Mum gives him 6 more, how many will he have altogether?'	5	-3	-2
Opportunities to talk about strategies for solving arithmetic problems and for children to express to one another the meanings that they construct for them	4	-3	0
Opportunities to create problems that require simple arithmetic solutions	2	-1	-2
Opportunities to tackle rich accessible tasks that require arithmetic understanding to solve them e.g. Playing the Dotty Six game from the NRICH website	-1	3	-1
Opportunities to engage with all kinds of arithmetic statements with different meanings and to examine their truth/validity e.g. $5 - 2 = 7 - 4$, $8 > 5 + 6$, $2 < * < 7 - 2$	3	-3	1
Opportunities to engage with statements in words and to express them in symbolic or iconic form e.g. The number of vehicles is equal to the number of vans plus the number of cars shown to the children with a picture of 2 vans and 3 cars in a car park	4	-6	1

The changes shown in Table 7.5 are small and could be at least be partly due to response bias given the respondents of the second survey did not represent the whole population. However, there appears to be slight pattern of more teachers seeing all of the different learning activities as necessary. Affirming that a statement was necessary implies that is an essential aspect of practice. Thus there is, perhaps, a slight change towards favouring a more varied pedagogy that encompasses all the opportunities outlined in the statements.

7.3 School impacts

When asked about other important impacts, some respondents in Survey 2, n=155, described school wide impacts: continuing collaborations developed within the schools (n=14); changes to calculation policies (n=8); and changes beyond Y3/Y4 (n=3). The case studies presented in [Section 10](#) below give examples of further school wide impacts.

8. Capacity and capability building

Although the main focus of this project was on changing classroom practice, it is clear that the project has supported the capacity for school-led mathematics professional development. This is cited by a number of schools as a significant additional outcome. Some 7% of schools cited developments in subject leadership as being the most significant 'other impact'. Given that respondents were not asked specifically about impacts on subject leadership this could be potentially higher. As will be discussed in Case Study 1, where networks were established that involved Mathematics subject leaders as well as Y3 and Y4 teachers, capacity and capability effects are likely to be greater.

As indicated in Section 5.1.2, the projects involved a significant number of those who had within school leadership roles but a smaller number, such as ASTs, who had engaged in system leadership activity. The project gave opportunities for a minimum of 31 teachers to lead projects across schools. The interschool aspect of the project was clearly valued by schools and the development of networks beyond schools and was cited by 36% of respondents as being the most significant 'other' outcome of the project. A further 5% indicated the capacity to lead CPD in and beyond their school was important. Thus, in total, 48% of respondents explicitly referred to increases in capacity as the most significant additional outcome.

In addition, the Project Lead has encouraged teachers who have the necessary capacity and profile to participate in the NCETM's Professional Development Lead Support Programme and seven have already done so.

9. Sustainability beyond the end of the programme

9.1 Within schools

The project appears to have had impacts in many schools that are likely to last beyond the length of the project. In addition when asked about next steps, 26% of respondents stated that they intended to focus on changes in practice beyond Y3/Y4 or, in some cases, mathematics. A further 23% made specific reference to reviewing or developing calculation policies or wider curriculum developments. A total of 25% cited areas of pedagogy for future development. A common word in many responses was reference to 'continuing' the work that had already begun.

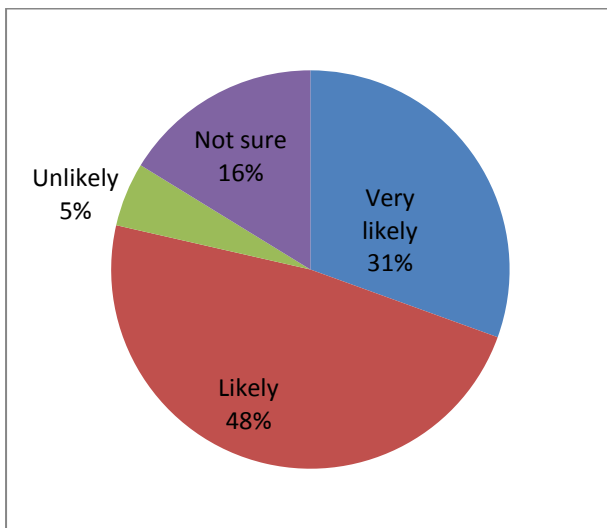
In addition, respondents also referred to CPD approaches that had been used and developing or sustaining a collaborative culture.

9.2 Network sustainability

As stated in above, a total of 81% (of n=155) of respondents strongly agreed, or agreed that the project has met the aim of developing a supportive network with the potential to support long term professional development.

Figure 9.1 below describes how likely participants feel they are likely to collaborate as part of their networks in the future (n=154). As with other questions, there is the potential for response bias here as those who have experienced the most success, and so possibly more likely to complete all questions in the survey, may be the most likely to collaborate with others in the future. Nevertheless, it is clear that the project has led to the creation or strengthening of many collaborative professional development networks.

Figure 9.1: Likelihood of network continuing to collaborate in the future



As stated above, a further two schools have applied for and been successful in gaining collaborative teacher project funding.

Schools were also asked specifically about their likely next steps in the network. Although this is another question where there is likely to be response bias with those intending to continue the work in the network more likely to respond, only 7% say they have no plans yet. Some of the future intentions are vague, but a significant number state intentions that are specific, as indicated in Table 9.1.

Table 9.1: Future intentions, n=145

Intention	Percentage
Keep in touch, share information	25
Future meeting planned	14
Develop calculation or other policies collaboratively	11
Share strategies	10
No plans yet	9
Another NCETM project planned	7
Specific joint activities	5
Plan collaborative CPD	4
Share resources	3
Set up a more local network	2
Peer coaching	1

10. Case studies

10.1 Introduction

A summary of key features of the four cases is given below and more details are provided in the Case Study reports.

Table 10.1: Overview of Case Study features

Case	No of hosts	Network size	No of Y3/Y4 teachers	Average CPD Hours	Arithmetic focus	Main CPD activities
C1	1	21	45	16	Number sense, four arithmetic operations, models and images, calculation policy, planning for new primary curriculum	Pupil conferencing Network meeting discussing outcomes of conferencing. Analysis of research evidence. Teacher enquiry
C2	2	14	19	15	Problem solving	Two sub-networks, lesson study
C3	1	6	19	11	Subtraction	Lesson study, involving team teaching, two cycles
C4	1	9	16	6	Multiplication and division	Discussion and sharing of ideas and practices, lesson observation and using resources from the NCETM website.

10.2 Case Study 1

10.2.1 Evaluation activities

- Visit to Host School: Interview with Host School lead and review of documents arising from the discussion
- Interview with Visiting School 1 – Maths coordinator
- Interview with Visiting School 2 lead 2, Maths Coordinator plus Y3 teacher
- Analysis of subset of survey data for the network (survey 1, n=21 and survey 2, n=12¹²)

¹² The proportion of respondents in survey 2 is 12 out of 16 that registered details with the NCETM. This is due to the fact that four of the schools were not funded. It appears that in Survey 1 the Host School may have passed on the survey link to schools not registered with the NCETM. The figures given are based on survey respondents' answers when asked to name their Host School.

10.2.2 Description of the network

Network 1 was sited in a large urban area. It was the largest network in the project with 20 visiting schools working with one host school (Host School 1). The project was led by an experienced Advanced Skills Teacher (AST) working in a school to be judged outstanding (and was granted Teaching School status during the duration of the project).

Of the 20 visiting schools, half were participating without funding. The NCETM had agreed to fund up to 10 visiting schools. Visiting schools were recruited by emails to 24 schools. These were ones that the AST have previously worked with in a support role or others known to the AST through existing network). Of these 18 wanted to join the project. In addition, two others heard about the project through word of mouth. Consequently, 10 schools (the first to apply) were funded and the others were not. Of the 10 unfunded schools, 6 registered their details with the NCETM. The schools worked in two parallel groups, with approximately 10 in each clustered geographically to support existing or to develop on-going relationships.

Most of the funding was used to buy equipment for the schools so that all schools could participate in project activities. The equipment, depending on need, Dienes blocks and Cuisenaire rods or, in most cases, Numicon. The project lead used the bulk buying power to obtain equipment at a discount from suppliers and passed discount on to visiting schools. The AST asked headteachers, as a condition of involvement, of the 'extra' visiting schools to buy the equipment needed for participation. Given this, it is worth noting that effectively this project was supported by the LA through AST time till end of March 2013 and by the school after that date.

The network leader found the PMHSPL support useful early on. The project plan developed by the AST in discussion with the PMHSPL was the most clear and well developed plan of those seen for the four case studies. The significance of the quality of leadership, passion and depth of pedagogical subject knowledge of the AST was identified by the visiting teachers interviewed as being important to the project success and noted by respondents in the survey. Although clearly led by the lead school AST, it is notable that another AST also become involved in the project from another school.

10.2.3 Reach

Approximately 45 participants took part, with two teachers from each school consisting of the mathematics co-ordinator plus a Y3 or Y4 teacher. Over half the schools participating reported that they were ethnically diverse, and similarly over half reported that they had above average numbers of pupils on free school meals. Of nine schools that provided data in Survey 2 on KS2 attainment, one was less than 60%, four between 70% and 80%, two between 80% and 90% and two over 90%. Thus, the network involved a broad range of schools with a slightly higher proportion with lower attainment levels, from this sample, than the overall cohort. This may be because the AST had previously been deployed by the LA to support schools facing challenges. Estimating on the basis of survey data, approximately 1000 pupils were in classes that benefited from the project.

10.2.4 Quality

Mathematical and other content

The focus of the network covered a wide range of areas in Primary arithmetic: Number sense; four arithmetic operations; fractions; models and images; calculation policy; and planning for new primary curriculum.

The mathematical subject knowledge and pedagogical subject knowledge issues addressed were in depth and covered key aspects of pupil learning. For example, in examining children's concepts of division and fractions, non-standard interpreting tasks were examined. The focus was on key conceptions, and misconceptions, that are important in arithmetical learning.

Professional development activity

The professional development activity was structured and coherent to ensure coverage of a wide range of issues in teaching and learning of arithmetic. An important feature of activity in this network was pupil conferencing. This is a form of teacher inquiry focused on close study of pupil activity and interviewing pupils about their mathematical understanding. The network lead suggested mathematical activities to do with groups of pupils and gave advice on how to engage in close observation of their responses. These were then discussed at PD events. Participants used pupil conferencing in a variety of ways, sometimes focusing on small groups of pupils and sometimes giving activities to whole classes and recording outcomes.

Network activity consisted of an introductory day to which the PMHSPL contributed on Hungarian mathematics following by two half days and two more full days, the last of these being a collaborative planning/peer support day focused on the new Primary Curriculum and revising calculation policies. In between network meetings, the network leader used the NCETM website and NRICH to find research articles, resources and ideas for pupil conferencing activities.

An average of 16 hours of PD engagement for practitioners was reported by respondents participating in Survey 2. This is likely to be an underestimate as at the time of the survey, the one half day and one full day of network meetings had not occurred.

One striking feature of the project was how the network lead emphasised the extent to which she, although already a highly competent mathematics teacher, had learnt from the project in terms of understanding children's progression and about arithmetic pedagogy. The project lead was a full participant in the professional learning community¹³ that she had instigated rather than an expert passing on knowledge to other teachers. The form of professional development that occurred echoes the notion of joint practice development¹⁴ in which, rather than good practice being transferred, the expert and/or school that exhibits exemplary practice develops their practice through working with schools they are supporting.

¹³ Stoll L and Louis K (eds.) *Professional learning communities: divergence, depth and dilemmas*, Maidenhead: OUP/McGaw-Hill.

¹⁴ Fielding, M. et al (2005), *Factors Influencing the Transfer of Good Practice*, Nottingham: DfES, Research Report. Hargreaves D (2012) *Leading a self-improving school system*. Nottingham. NCSL.

Overall view of quality

The visiting teachers interviewed were also very positive about the forms of CPD and overall quality. This is also shown by survey outcomes.

Table 10.2: Case Study 1, success in meeting project aspirations, n=12

Success in meeting project aspirations (percentages)	Very successful	Successful	Neutral	Unsuccessful	Total
To collaborate with other teachers in exploring some of the issues that are key in developing fluency and understanding of arithmetic in years 3 and 4	83	17	0	0	100
To learn from other schools who have been successful in teaching arithmetic in years 3 and 4	8	67	0	0	100
To develop a supportive network group that has the potential to support our long term professional as teachers of mathematics	58	17	25	0	100
Develop knowledge about arithmetic	67	17	25	0	100
Learn about using curriculum materials and resources	33	58	8	0	100
Learn about recent developments in teaching arithmetic and research	44	42	17	0	100

Comparing this data with that for the project overall ([section 6.5](#)) indicates that a particular relative strength of this project was collaboration with other teachers and developing knowledge about arithmetic, and to an extent, learning about recent developments in teaching arithmetic and research. On one item 'to learn from other schools who have been successful in teaching arithmetic in years 3 and 4', the number strongly agreeing is lower than for the overall population (8% against 43%). This is notwithstanding that the combined strongly agree/agree is broadly similar. This may reflect the joint practice development approach in this successful project in which all involved were learning together.

10.2.5 Impact

Pupil

The majority of respondents to Survey 2 (10 out of 12) reported an increase in progression comparing the 2012/13, Y3 and Y4 cohorts, to 2011/12.

The proportion of respondents agreeing, or strongly agreeing, with statements about pupil impacts (see [section 7.1.1](#)) is between 75% and 92% across different statements, with similar to the overall cohort. Specific impacts stated by respondents were:

- a lot of children have more clarity of which strategies can be used to solve different problems. Children enjoy being able to apply their knowledge to rich tasks.
- better at explaining and taking risks.
- better at using the inverse.
- better understanding of number with the result that children are more confident at mental calculations.
- confidence with using resources, e.g. Numicon, Dienes etc.

- increased independence to find out answers themselves.
- more able group are more challenged and expectations are now higher.
- more mathematical discussion.
- their increased ability to explain their understanding of how they solve problems.
- their engagement with the subject.
- using improved understanding to solve calculations presented in non-routine ways.

These impacts are in keeping with the Primary Narrative's emphasis on fluency and understanding as the foundation for problem solving.

Teacher

Survey data and interviews both indicate that the two most significant impacts on teachers' knowledge and practice were a better understanding of children's arithmetic progression and an understanding of how to use equipment and manipulables as a bridge to the development of abstract concepts.

School

One respondent to the survey states that 150 children had been in classes whose teachers were involved in the project indicating a level of involvement that is likely to lead to whole school effects. In Visiting School 1 (C1V1), the mathematics coordinator is revising calculation policy and practice in other years. In Visiting School 2 (C1V2), the mathematics coordinator and Y4 teacher have convinced the headteacher to invest in resources that would support greater use of models in teaching across both Key Stages and to revise the calculation policy accordingly.

In the survey a number of respondents indicated school wide changes:

- use of a times tables method - to be used school-wide.
- agree on a school calculation policy and use this to guide teaching.
- extend strategies to other year groups.
- apply consistent approach to calculation across the whole school.
- re-develop our calculation strategy to involve examples of appropriate models and images across all year groups.
- to use a wider range of resources (Numicon, Dienes etc.) to support arithmetic teaching and to share findings from the project with staff.

10.2.6 Capacity and capability building

In Visiting School 1 (C1V1) the mathematics co-ordinators', previous role was as a Numbers Count teacher and the new role of mathematics coordinator made new demands. The PMHSP has supported her to take on a mentoring role with a Y3 colleague and developed her confidence, she is now taking a leading role in a new mathematics network and is seeking to share ideas with other schools with which she has existing relationships. She directly attributes involvement in the PMHSP as giving her the confidence to take on these new leadership responsibilities. The mathematics coordinator in Visiting School 2 (C1V2), is taking up a new role in another school that is in more challenging circumstances than her current school. Relationships formed during the PMHSP that led her to consider the new post.

A new local network (distinct from the networks centred on the Host School) has grown out of the project that is being led two of the Visiting School teachers.

10.2.7 Sustainability

The final day of the project, taking place after the evaluation visit, was planned to have a focus on reviewing calculation policies and on planning for the new curriculum. As can be seen from the school wide effects it is likely that positive outcomes of the project will be sustained and extended. In addition, participants in the survey detailed particular aspects of practice that they intended to continue.

Further, 11 out of 12 participants responding to Survey 2 say it is likely or very likely that they will continue to collaborate in the future as part of the network (the other being 'not sure'). As stated above, a new local network has grown out of the project.

Perhaps most significantly, the Local Authority Mathematics strategy group is exploring the possibility of funding or facilitating schools to buy into a self-financing project that would aim to repeat the success of the NCETM project.

10.3 Case Study 2

10.3.1 Evaluation activities

- Visit to Host School 1: interviews with the lead
- Visit to Host School 2: interview with the lead
- Analysis of survey data
- Review of report from Visiting School teacher in PMHSPL report.

10.3.2 Description of the network

The network in Case Study 2 formed as the result of two schools both wishing and able to be Host Schools, that were situated in the same Local Authority area and only about four miles apart. It was agreed by the PMHSPL that they could both work together as joint Hosts but with one school designated officially as the network lead. Host School 1 was a small Endowed village school in a rural area but close to the large town where Host School 2 was a big Junior School. Host School 1 asked all the nearby rural schools if they would like to be involved: they all agreed and did the initial survey but one school later withdraw due to staff sickness. Host School 2 also recruited their nearest local primary or junior schools, seven in all. Both network leaders were MaST teachers and both schools had Ofsted rating of Good. The schools supported the project by allowing and covering for teacher release beyond the funding available, with some funding being used to support continuation of the project into next year.

The first meeting of all the teachers involved was an after-school session in November to explore the issues in teaching arithmetic in years 3 and 4 and plan what they were to do as a group. It was agreed that problem solving was an identified area needing improvement and that the group could use Lesson Study as an approach. Because of network size and distances, schools met in two sub-networks, a suburban and a rural one.

Group activity followed the Lesson Study format of agreeing a focus, joint planning and observation. Following shared observation, all group members taught the same lesson to their own classes and they then met to discuss it. Two lesson study cycles were completed by each group. There were two further after school sessions led by the network leaders.

10.3.3 Reach

Some 19 year 3/4 teachers were involved in the project from the 12 schools that completed the project, with an additional 32 other practitioners. Of these 25 attended the PMHSPL after school session.

One issue that is important to note in relation to this Case Study is that of cross age classes: one of the rural schools with four classes has a year 2/3 and a year 4/5 class. All the other rural schools had year 3/4 classes which were the ones chosen. The town/suburban schools chose either year 3 or year 4 or both depending on particular circumstances. Approximately 560 Y3 or Y4 pupils benefited from the project.

10.3.4 Quality

Mathematical and other content

The focus of the project was on developing and using arithmetic calculations in problem solving contexts.

Professional development activity

As described above the main PD activity was Lesson Study. Participants reported engaging in an average of 15 hours of CPD activity.

The project gave the schools a focus for joint activity with a clear structure and a reasonably quick outcome. The passion for the project, the immediacy of the effects on the teachers involved and the children, the realisation that working together can sustain the professional development of the individual and provide challenge came through all the conversations.

Overall view of quality

Survey responses indicate a positive view of quality by most participants.

Table 10.3 Case Study 2, success in meeting programme aspirations, n=12

Success in meeting project aspirations (percentages)	Very successful	Successful	Neutral	Unsuccessful
To collaborate with other teachers in exploring some of the issues that are key in developing fluency and understanding of arithmetic in years 3 and 4	46	46	8	0
To learn from other schools who have been successful in teaching arithmetic in years 3 and 4	54	39	8	0
To develop a supportive network group that has the potential to support our long term professional as teachers of mathematics	62	23	15	0
Develop knowledge about arithmetic	15	39	46	0
Learn about using curriculum materials and resources	23	62	15	0
Learn about recent developments in teaching arithmetic and research	15	23	63	0

The table indicates that the project was successful overall. The two areas with higher 'neutral' response relate to knowledge about arithmetic and recent developments, this may be due to the specific focus on problem solving.

10.3.5 Impact

Pupil

In terms of test scores, one of the two lead teachers felt that it was too soon to see any effect on SATs scores and was concerned to know what an increase in the score would actually show in terms of pupil progression or of the effect of the project. The other lead felt that the scores had been increased by about 5 or 6%. Both schools had had problem solving in arithmetic identified as an area to focus on by Ofsted and themselves. By the end of the project, the teachers felt that the children were now more able to understand what was being asked and so could do it.

Survey responses about changes in children's mathematical learning referred to improved oracy, more confidence and enthusiasm and collaborative skills.

One of the network leaders had asked the children at the beginning of the project to draw a picture of the class doing mathematics. Most of the children drew pictures of themselves sitting alone at their desks with an open text book and an exercise book 'doing sums' with the teacher at the front. After the end of the project, she repeated the exercise and the children drew pictures of themselves playing mathematics games and talking about what they were doing. The teacher was to be found at a table playing a mathematics game. She is intending to ask the network group to repeat this with their classes.

Teacher

Teachers reported positive impacts in the survey on their practice in line with the cohort as whole reported above.

A fuller description of the effect of the project on one NQT teacher is reported in the Primary Mathematics Host Schools Project Lead report.

School

The rural schools reported that everyone on the staff, head, teachers and teaching assistants were involved in the project and committed to it. The town school had reported that the effect on the four Y3 and Y4 classes was marked and hoped to extend this throughout the schools.

10.3.6 Capacity and capability building

Both the lead teachers commented that they had not previously been responsible for organising and leading INSET at such a level and had thought that they were not able to do that – an underlying notion that the “outside expert” was needed. Once they were involved they met each challenge and supported each other. One of them commented that although the schools were in very different circumstances the challenges that the lead teachers met in terms of their staff were very similar.

The project enabled one of the lead teachers to report that

“[the project] ..built on the MaST and[it was] amazing being able to improve my own maths knowledge and teaching [while] .. building skills of mentoring and coaching and leading ...I couldn't have done this without the project”

The understanding of the benefits of the project for the lead teachers in developing their professional skills of working with and leading other teachers were an unexpected consequence and very welcome side effect of the project.

One of the most notable results of the project in these two schools is the effect that involvement had on the two lead teachers in enabling them to demonstrate leadership in running CPD.

Both lead teachers from these schools attended the final Birmingham meeting and presented a report of their lesson study project. They are due to present the project and their results at a STEM conference in the summer.

10.3.7 Sustainability

Plans for continuing the project into the next academic year are well under way with dates being fixed for meetings and topics for focus being debated. A total of 12 out of 13 teachers stated that it was very likely or likely that they would continue to collaborate in the network.

The lead teacher from the town school – a junior school - is currently engaging in a Lesson Study project focused on using division in real life situations with a Y2 class in the feeder infant school. Two infant teachers from the infant school and two junior teachers from the junior school were going to plan the lesson together and then watch one of the infant teachers teach it. The process would be repeated with planning for a similar division lesson for Y3 which the junior teacher was to teach, observed by the others.

10.4 Case Study 3

10.4.1 Evaluation activities

- Visit to Host School: interviews with the head and the lead
- Contact with one of the other schools: awaiting report [half term preceded by SATS week]
- Analysis of survey data

10.4.2 Description of the network

Case Study 3 was a network of six schools in total, all close to the Host School. The Host School has a significant number of pupils from the minority ethnic community and a number at the earliest stages of learning English. The proportion with Special Educational Needs and/or disabilities is well above average.

The Host School had previously undertaken a lesson study in 2010/11 with the NCETM which they had found useful and they were looking for a linked project on Lesson Study. The project was led by the Mathematics Co-ordinator (a Y5/Y6 teacher) with active support from the Host School headteacher. The Host School chose to limit the network size to six including themselves even though a total of twelve local schools showed an interest. The choice was because it was believed that this was an optimal size group.

10.4.3 Reach

The network involved 21 Y3/Y4 teachers and 18 other practitioners across the five schools with 430 Y3/Y4 pupils directly benefiting.

10.4.4 Quality

Mathematical and other content

The focus was the difficulties in teaching and learning about subtraction, using Lesson Study as a method. This was supported through reading about research in the subject from various sources including those uploaded onto the portal by the lead school and emailed to members of the group.

Professional development activity

The average number of CPD hours reported for those directly involved was 11 hours; this was the highest total for a network of this size or smaller.

The network met eight times over the project with clearly defined aims and objectives for each meeting and tasks to be completed by the group in between each meeting. The Lesson Study process is given below in some detail as it may be useful as a basis for description to guides others in future similar projects.

Meeting 1: half day

A half day introductory meeting at which the ground rules of the project were set and all dates booked into diaries. The over-arching theme was to be mathematical thinking in Y 3/4 in arithmetic and the method was to be lesson study. The group discussed where they were as schools and where they wanted to be and how they were going to plan to fill the gap through learning and teaching. The Host School got to know the context of the Visitors' Schools and the

sort of activities that they had done. Each teacher was asked to research some of the issues underlying difficulties in learning arithmetic particularly in subtraction. Some prepared readings had been put onto the NCETM portal to make them accessible to the whole group and others were emailed to the group by the host school.

Meeting 2: 2 hours after school

A research review: everyone presented something that they had learnt from the suggested readings and their study of the Ofsted and HMI reports. The key points were circulated to the group and all notes and reports were put on the portal so everyone could access them. The importance of evidence based actions was emphasised.

Meeting 3: after school

Started lesson planning and agreed how this was to work with the emphasis on reflection and shared concepts with the rest of the group.

Meeting 4: after school

The group teased out the concepts involved in year 3 subtraction, developed a model to support pupil understanding and thought about the tools used to help teach it. As a group, they then planned the first lesson to be team taught by teachers from two different visiting schools (C3V1 and C3V2) to one of their classes. They established the success criteria looking at how the children may respond, how they can explore misconceptions and the children's reasoning and knowing when to intervene. They discussed the language used and the lesson was agreed by the group and was written up by the facilitator.

Meeting 5: am

All members of the group went to school V1 for the lesson which was taught by teacher C3V1 and C3V2 over about 1.25 hours. After a quick thank you and well done, everyone went back to their own schools to 'mull over' the process ready for the next day after school meeting to discuss how it went.

Meeting 6: after school

The following day an after school session was held with the PMHSPL to evaluate how that lesson had gone and to share the children's recording and the video. The discussion was around what went well and what needed to change. The group agreed that little needed change and made slight amendments for the next lesson to be taught by C3V3 and C3V4 in CV3's school.

Meeting 7: am

The same lesson was taught to the children in year 3 of school V3 by teachers C3V3 and C3V4 and the process repeated.

Meeting 8: after school

The group considered the effect of the amendments to the first lesson: the changes in the impact of the teaching and the overall result. This last session then looked at evaluating the whole project.

Overall view of quality

The network lead believed that the project was successful. The lead cited teachers' willingness to teach in each other's schools, the quality of the teacher/teacher dialogue, participation in the reading and the pre-project research, and teachers' enthusiasm.

Survey outcomes indicate that the participants considered the project to be a success.

Table 10.4 Case Study 3 Participants' view of success in meeting project aspirations, n=6

Success in meeting project aspirations (percentages)	Very successful	Successful	Neutral	Unsuccessful
To collaborate with other teachers in exploring some of the issues that are key in developing fluency and understanding of arithmetic in years 3 and 4	84	17	0	0
To learn from other schools who have been successful in teaching arithmetic in years 3 and 4	84	17	0	0
To develop a supportive network group that has the potential to support our long term professional as teachers of mathematics	67	33	0	0
Develop knowledge about arithmetic	83	17	0	0
Learn about using curriculum materials and resources	50	33	17	0
Learn about recent developments in teaching arithmetic and research	67	17	17	0

10.4.5 Impact

Pupil

In the survey all respondents indicated that either they strongly agreed or agreed that their pupils enjoyed arithmetic more and had more confidence in dealing with new problems. In addition five out of six agreed or strongly agreed that pupils were able to recall facts more easily and were generally more confident in arithmetic. Four respondents agreed or strongly agreed that pupils were better at solving work problems.

Some of the year 2 and year 5 classes also used Lesson Study to feedback to teachers. They used the structure to observe the lesson and make sensible suggestions and reflective comments.

Teacher

All the teachers responding to the survey, when asked to indicate the main effects on their practice, selected 'I use a wider range of representations and models in my practice'. In addition five out of six indicated that important changes were teaching for understanding and/or for fluency.

Teachers reported a range of other positive outcomes on their practice:

I feel it has widened my own understanding and made me more open to the subtleties of children's questioning and more ready to explore them.

It has opened up the idea of researching new concepts for teaching maths and not just stick to the strategy that has been used in the past.

More reflective approach to teaching arithmetic rather than just practising list of calculations.

Offering more opportunities for children to reflect on their own understanding and to discuss their choices in meaningful situations.

We have developed a deeper, research-based understanding of subtraction that has emphasised the empty number line as a key model and constant difference as a particularly effective strategy.

Engaging with current, and recent, research relating to arithmetic. This has helped greatly in informing effective planning and teaching, particularly when pre-empting possible misconceptions.

School

Effects at school level are clearest in relation to the Host School where lesson study is well established. The Host school reported that Lesson Study is now a fundamental part of the school ethos. All observations of staff are collaborative with at least two teachers so the professional dialogue can be extended. The number of staff meetings has been radically reduced so that there is time for Lesson Study meetings. At any one time, two out of four phase groups are doing Lesson Study. A similar model is used with joint research, reflection and preparation. For the four classes in a group, there will be a session of joint preparation as in the project and then one teacher will teach the lesson with the other three observing and feeding back. They will then teach the same lesson to their classes.

The Head has now started a Lesson Study project for TAs with group support on how and when to intervene and how to offer individual support.

10.4.6 Capacity and capability building

The differences that the project has made to the school are significant. Because of the previous involvement with lesson study, the school was ready to take on another challenge using the same technique and to work with other schools. The lead teacher of the Host School has now extensive experience of leading a project which involves a group of schools working together on a topic. Teachers from Visiting Schools also indicated that their capacity to lead professional development in their own settings had developed.

10.4.7 Sustainability

A major positive outcome in terms of sustainability is the desire to replicate Lesson Study and/or to share outcomes of the project in teachers' own schools.

The following are the next steps indicated by the participants:

Begin using Lesson Study with year 3 and year 4 teachers, looking initially at the area of subtraction.

Continue the reflective pattern, planning in opportunities for children to discuss and argue benefits of different strategies in different situations. Also, carrying this thinking through to different subjects in the primary curriculum. I also intend to carry out Lesson Studies within my own school to improve teacher's reflective practice and encourage research.

Begin using Lesson Study with year 3 and year 4 teachers, looking initially at the area of subtraction.

Further Lesson Study cycles on the other three operations.

I intend to discuss curriculum development projects with the SLT and see if there are any opportunities to continue it at my own school.

My next steps for arithmetic teaching are to use research to support writing a new calculation policy so that the impact of this project can be implemented across the school.

To further develop mental strategies at my own school.

In terms of sustainability of the network, all survey respondents indicated that it was likely they would continue to work together.

The lead school has offered to continue to support the other schools next year and is already planning to work with one school with their year 6 pupils. Other staff are being encouraged to use the portal to access information and reports of what is happening elsewhere. Specific plans stated were.

As part of a lesson study within my own school, I will draw upon the experience and expertise of the staff at the host school. Also, possible collaborating on future curriculum changes.

Developing cross-school lesson study.

10.5 Case Study 4

10.5.1 Evaluation activities

- Visit to Host School
- Visit to Visiting School
- Analysis of survey data
- Review of description of the project in PMHSPL report

10.5.2 Description of the network

The network consists of six schools, in a suburban area, three of which [based on Ofsted reports] are outstanding, two good and one satisfactory. The network arose from an email sent close to the deadline to the head of the Host School, a Teaching School, from NCETM and then forwarded to a deputy heads' network the school is part of asking if anyone else would like to be involved. The deputy head then emailed all the local deputies with whom he had contacts and the schools were recruited.

The two teachers from the Host school attended the first national meeting.

10.5.3 Reach

Survey 2 reports that 16 teachers with classes in Y3 and Y4 were directly involved with the programme with another 14 indirectly involved. However, this does not include data from all the schools, including the Host School, and so the numbers may be higher.

10.5.4 Quality

Mathematical and other content

As well as a general focus on Year 3 /4 arithmetic the particular focus was on multiplication and division.

Professional development activity

After some discussion at the first after school meeting in December, the group decided on multiplication with division to be seen as the inverse. This meeting then decided on a pre-test which was refined by the Host School and emailed to the others to use.

Professional development activities involved discussion and sharing of ideas and practices, lesson observation and using resources from the NCETM website.

The PMHSPL ran a study day in the Host School on March 7th which was attended by the Lead Teachers involved in the project. The teachers present reported that they found it valuable or very valuable, particularly her expertise and knowledge sharing, information about group networking and sharing ideas, how mathematics is taught around the world, research, other styles of teaching and subject knowledge.

The new mathematics draft curriculum was examined and the whole group observed four short starter lessons for year 4 taught using the observation room in the host school which meant that the class was not disturbed and the camera could be remotely controlled to focus on particular children or activities.

The mean number of hours of CPD reported for these teachers was six hours for those involved, lower than the project average, and the lowest for a network of this size and 23rd out of 27 networks. This may be in part due to the Host School not participating in the survey as host schools tended to report higher levels of CPD than others, thus this depresses the average relative to other networks. However, it appears that the forms of CPD used did not generate the same level of participation as in the other Case Study networks.

Overall view of quality

Table 10.5.4 Case Study 4 Participants' view of success in meeting project aspirations, n=5

Programme aspirations (percentages)	Very successful	Successful	Neutral	Unsuccessful	Total
To collaborate with other teachers in exploring some of the issues that are key in developing fluency and understanding of arithmetic in years 3 and 4	40	60	0	0	100
To learn from other schools who have been successful in teaching arithmetic in years 3 and 4	60	40	0	0	100
To develop a supportive network group that has the potential to support our long term professional as teachers of mathematics	20	80	0	0	100
Develop knowledge about arithmetic	0	80	20	0	100
Learn about using curriculum materials and resources	20	80	0	0	100
Learn about recent developments in teaching arithmetic and research	40	40	20	0	100

This is in keeping with the overall percentage responses to this question for the whole cohort. (see section 6.5) Thus it seems that although the project did not involve as much activity as others, it was deemed by participants as successful.

10.5.5 Impact

Pupil

Teachers reported that there had been changes in the children's mathematical learning during this project. One teacher reporting that the children were all enjoying maths more: another that they can explain their thinking, use the inverse and 'what they know' to help them: another to show more enthusiasm and are more engaged in tasks and are often more confident and enthusiastic and in one case an improvement in children's recall of mental facts was identified.

Teacher

The teachers reported that they would put in place some changes in the teaching of arithmetic in their schools as a result of this project. They were quite clear about the impact of the project on them at this time, reporting that they now had:

Better awareness of concepts related to early maths acquisition and the way they affect development of more complex mathematical ideas. Use of different games to practise different skills and engage different learners. Debate around Hungarian early years maths teaching and ways that could be used to support our current curriculum.

Far more practical and visual. More consolidation

Fresh, additional, hands-on, practical ideas to add to what they are already doing.

More practical and engaging lessons

Using more games and building mental maths into activities throughout the day

The teachers were looking at the other outcomes of the project that they considered important and reported the following positive features:

A chance to reflect and improve practice

Great to develop links to teachers of same year group in other schools. Good to slot experience of teaching in other year group into this context

Mainly sharing ideas with other teachers.

Providing activities that ensure all pupils are engaged and active

The network has been great to discuss ideas

Thus, it appears that the five respondents found the network useful for their personal professional development.

School

The next steps that the teachers reported involved working with their home school staff to develop the whole school:

Continue in my role as numeracy co-ordinator and hopefully continue to inform staff of new developments and ideas

Continue to review the Hungarian methods and share with the school to see if this is worth implementing

Share ideas with whole school and develop clearer progression with a view to plan accordingly for the new curriculum

Sharing what we've learnt to the whole staff

10.5.6 Capacity and capability building

There was limited evidence of individual capacity and capability building. The network built on an existing network between deputy headteachers across the schools and this has now been extended into a mathematics specific network.

10.5.7 Sustainability

The Host School lead reported that they want to keep the network open, meeting one evening every term and a day a year. Three out of five survey respondents indicated that they would be likely or very likely to continue to participate in the network.

It is possible that the project could move forwards and plan for future activities. It would appear that there needs to be a further driver to encourage this group to sustain its activities across the network. Asked to describe the plans for the future, they reported:

Continue to share resources and discuss ideas

Meeting up again has been discussed but no firm plans have been made.

None yet

Share good practice and ideas generated at the host school.

Sharing ideas with staff in staff meeting

11. Enabling factors identified from the case studies

Analysis of the case studies indicates that the following are important enabling factors in highly successful networks:

- passionate leadership by mathematics subject leaders;
- shared leadership;
- building on existing networks/relationships;
- networks of sufficient size to develop and maintain momentum
- professional development activities that involve teacher enquiry into pupil learning such as Lesson Study and pupil conferencing;
- the involvement of more than one practitioner in each collaborating school;
- activities to focus PD between formal sessions;
- a clear development plan
- regular professional development activity sustained over a number of months;
- access to external expertise;
- evidence based enquiry during research and/or academic study;
- and support of school leadership.

12. Other issues

12.1 Participants' views on payment made to them

The table below gives participants' view of the payment made to them. It should be noted also that 15 schools participated without funding. Payments made to schools were used to fund cover, meeting expenses, and in at least one case, purchase of equipment.

Table 12.1 Participants' views on payments made to them, n=142

How important was the payment to you in engaging successfully in this project?	
	Percentage
Very important	42
Important	26
Neutral	18
Not important	3
Did not receive payment	11
Total	100

12.2 Other issues

Participants were asked in survey 2 if there were any other issues that they wished to comment on 92 of 149 responding to the question specifically states there were not other issues. Of the remaining 53, a total of 38 either stated that the project was excellent, very good, useful, expressed their thanks or mentioned a specific positive feature of their project such as working with colleagues. A small number of participants (n=7) reported a less satisfactory experience with specific issues mentioned being the project aims unclear and that

people did not commit or they could not attend meetings. Some 15 of the 53 praised the NCETM website or the forum with 4 of the 53 criticising the website.

13 Value for money

13.1 Comparison with other provision

The overall cost of the project as an extension to the NCETM contract was £247,275.

In [Section 5.1.1](#) the number of participants was estimated and in [Section 6.3.3](#) an estimated range of hours of CPD was calculated as 8400. This allows the proportional cost per person and per hour of CPD to be calculated (2 significant figures). These are compared below with the cost of a typical one day CPD course with a private provider of £250 (note this does not include possible supply costs).

	Per participant	Per CPD hour
Primary Mathematics Host Schools Project	£227	£15
One day course	£250	£40

Figure 13.1

As can be seen from a purely financial comparison there are indications that the Primary Mathematics Host Schools Project has represented value for money in comparison with alternative CPD.

In addition to this evidence of cost effectiveness, the PMHSP has offered the following additional value:

- engagement for many practitioners in forms of CPD that are known to be more effective than single day courses;
- professional development focused on a specific recognised need - arithmetic proficiency in Y3 and Y4;
- opportunities for PD with a nationally recognised mathematics educator offering tailored CPD and consultancy to participating schools;
- the development of leadership capacity to lead mathematics professional development within over 200 schools and for leadership across schools in 31 host schools;
- the strengthening or creation of potentially sustainable collaborative professional development networks with 79% of schools likely or very likely to collaborate in the future;
- publications in professional journals that reach a wider range of teachers.

14. Discussion and recommendations

The Primary Mathematics Host Schools Project was successful, overall, in meeting the project aims. There is evidence that it has been a cost effective form of mathematics professional development for primary teachers. It has contributed to the aim of school led system wide improvement. These positive outcomes indicate that it represents a positive model of professional development that could be replicated.

Recommendation 1: The NCETM and DfE should consider repeating the PMHSP for other aspects of Primary Mathematics and/or year groups and using it as a model for secondary professional development.

In part the success of the project lay in features of its design: school networks led by subject leaders; nationally linked networks; a common specific focus across the networks; encouragement to engage in high quality forms of professional development; and external support by a highly experienced and proficient national expert.

Recommendation 2: These positive features should be replicated in future similar projects.

An emergent feature of the project was that in many cases, and in some of the most successful projects, the relationships between schools did not match the original conception of 'Host' and 'Visiting' schools. Professional development activities took place in a range of settings and not just at the Host Schools. Further, Host Schools also reported professional development benefits, this is not surprising given the within school variation in teaching identified by OFSTED in mathematics. A number of networks re-designated some Visiting Schools as unofficial Host Schools.

Recommendation 3: The NCETM should review the classification of 'Host' and 'Visiting' Schools in future similar projects and consider instead terms such as Lead and Collaborating School or similar terms.

The project had a significant reach in terms of number of Y3 and Y4 teachers involved as well as other practitioners. The project may have been less successful than intended at targeting those schools that are underperforming. There are two likely reasons for this:

- the short timescale of the lead into project that meant Host Schools relied on existing networks
- a lack of guidance and support to Host Schools about identifying underperforming schools

If a similar project is run again attention must be also paid to specifying in more detail the desired characteristics of the collaborating/visiting schools.

For future similar projects:

Recommendation 4: the DfE and NCETM should allow for a longer timescale for recruitment of Host and Visiting schools¹⁵.

Recommendation 5: the NCETM should provide greater guidance and support to Host Schools and, in other contexts, other professional development leaders, about the importance of targeting, and ways to target, underperforming schools for involvement. Guidance for applications should make the priority of supporting underperforming schools clear to applicants.

The nature and amount of professional development varied considerably across networks. In order to increase the effectiveness and value for money of future projects, the following recommendations are made.

For future similar projects the NCETM should:

Recommendation 6: specify a minimum network size of 6 Visiting Schools per Host Schools as larger networks tended to be more successful and have greater reach.

Recommendation 7: provide Host School applicants with a number of successful models drawn from the Case Studies in this project and from other NCETM projects, that encourage participation by more than one person from each school involved.

Recommendation 8: prioritise applications using those forms of CPD most likely to lead to favourable outcomes such as Lesson Study and teacher enquiry into learning such as pupil conferencing. Guidance for applications should make these priorities clear to applicants.

Recommendation 9: support collaboration between leaders of primary networks for example through joint leadership or networks running in parallel.

Recommendation 10: extend the length of projects as this is likely to lead to more positive outcomes from the professional development support. Ideally, recruitment and contracting would happen over one term and project activities would then take place over a full school year.

A weakness of this evaluation is the lack of reliable data on possible impacts on pupil attainment as well as the reliability of data on school profiles. Recommendation 10 (above) would help to address this issue as it would be possible to use schools' pupil performance data. This would be made easier if the evaluation period was extended at least a term beyond the life time of the project. An alternative way of assessing impact on pupils' understanding is through the use of a specific pre- and post-test measure. Although unsuitable for many professional development projects, in the case of the Primary Mathematics Host Schools Project, with its specific focus on two year groups and arithmetic calculations, this may have been feasible. Here, caution is advised as there is a danger that using such a measure could distort the professional development activities instigated from a focus on pupil learning and

¹⁵ This will also support other recommendations made in relation to improving effectiveness and quality, for example, by being able to more selective of applicants.

teacher behaviour to 'teaching to the test'. However, the type of pupil conferencing activities used in Case Study 1, as well as similar sophisticated tasks that focus on conceptual understanding as well as fluency could be adapted to this purpose. They could, too, offer a focus for professional development in themselves.

For future similar projects the NCETM should:

Recommendation 11: extend the time for evaluation by schools of projects to allow them to use end of year pupil performance data.

Recommendation 12: consider using reliable specific measures of impacts on pupil learning for projects where the focus is specific enough to allow this, selecting those measures that are likely to be a potential source of professional development themselves.

Recommendation 13: gather data on participating schools that uses national measures of socio-economic need and school characteristics either from schools or from DfE sources.

14. Conclusion

The Primary Mathematics Host Schools Project was a new initiative by the NCETM. Whilst there are some lessons to be learned for the future, these should not detract from the evaluation finding that it was, for the most part, successful in meeting the programme aims and objectives. It provided participants with high quality professional development that had significant reach and enhanced the capacity within and across schools for school-led professional development. There are indications that in many networks and schools improvement will be sustainable. Overall, the project appears to have provided value for money in comparison with alternative CPD possibilities and it has contributed to both improvements in mathematics teaching and the aim of school-led system-wide improvement.

Annexe: A narrative about arithmetic

TIMSS results show that pupils in English schools are relatively weak in number manipulation aged 10. They go on to perform poorly in number and also algebra aged 14, and there is a strong correlation between students leaving primary school without having achieved the expected level in mathematics, and not reaching the critical C grade at GCSE.

There is a growing consensus that:

- children must be able to recall quickly and accurately basic “number facts” (e.g. number bonds and multiplication Figures);
- children must be fluent in applying quick, efficient written methods of calculation; and
- Some children have become over-reliant on intermediate methods of calculation (such as “expanded methods” and “chunking”). While these can be useful to illustrate how calculation methods work, they are slow and cumbersome as long-term methods. Children need to be moved on rapidly to use appropriate efficient written methods, rather than becoming dependent on intermediate methods.

Debate around the teaching of primary mathematics often opposes **procedure** (i.e. developing children’s fluency with algorithms) against **understanding** of mathematical concepts. However, it is unhelpful to see fluency and understanding as in opposition. The recent Ofsted survey of good practice in primary mathematics shows that many successful schools successfully teach **both** fluency in mental and written methods of calculation, **and** understanding of the underlying mathematical concepts.

Fluency with procedures gives children the fundamental skills they will need in the long term, as well as empowering them to get to reliable answers in the meantime. Both a firm foundation in conceptual understanding and plenty of practice in the use of these procedures are key factors in establishing fluency. Children need to understand and use the mathematical concepts that underpin number and arithmetic, such as place value and proportion. Without such concepts, pupils are ultimately less able to perform mental or written calculations, solve problems and reason mathematically.

Every school should have a clear calculation policy, setting out the approach towards a quick, efficient calculation method for each operation that will be used throughout the school – and this should be rigorously applied and understood by all staff. No child should be labouring with interim calculation methods in the long term.

All children *must* leave primary school *both* proficient in the school’s arithmetical algorithm for each operation *and* with a good understanding of the underpinning mathematics, both of which will equip them for solving unfamiliar problems and as a foundation for the more complex mathematics they will be taught in secondary school.

Annexe B: NCETM website information about the project

The NCETM Host Primary Schools Project: supporting schools with arithmetic proficiency in years 3 and 4

This is a project taking place during 2012/13 to support a national network of primary schools in their development of children's arithmetic proficiency.

The project intends to support teachers in addressing inconsistencies in approaches to teaching arithmetic and to improve children's understanding and skills in applying arithmetic techniques to a variety of problems that reveal the structure, beauty and power of mathematics.

It aims to support all the schools taking part in securing the arithmetic proficiency of the lowest attaining children in years 3 and 4, whilst offering the highest attainers in those years opportunities to deepen and develop their understanding of arithmetic procedures and apply them to increasingly complex problems.

The work of the project will build on the findings of the Ofsted Outstanding Schools and Made to Measure Reports about progression in arithmetic proficiency and the need to increase the emphasis on solving problems with arithmetic solutions.

The project will provide schools with support in developing their approach to arithmetic teaching across the school.

Host Schools

The NCETM is interested in working with primary schools that have a good or outstanding record in the teaching of arithmetic and especially interested in identifying Host Schools with a story to tell about how they have improved children's arithmetic skills in recent years. These stories of improving arithmetic proficiency will serve as exemplars to the Visiting Schools with whom the Host Schools will work.

Ideally, Host Schools will have a mathematics 'champion' on the staff. This might be an AST, SLE, MaST alumni, or a mathematics co-ordinator who has a passion for mathematics and its teaching and learning as well as experience of supporting colleagues in their professional development.

The project will be spread among up to 30 schools spread throughout England. These Host Schools will support a local network of schools, which will be designated;

Visiting Schools

These will be schools who would like to improve their children's fluency in using and applying arithmetic skills and reasoning to solve problems. They will have understood the implications of the Ofsted reports, and recognise that working with other schools can help them in their own important work.

Project details

Host Schools will be supported by funding to cover some of the costs of releasing staff for visits, network support and other expenses. Visiting Schools will also benefit from funding to support their staff with such expenses as they take part in these networks

Specific CPD packages which will be available on the NCETM website to all the participating schools to aid their networks

Schools, both Host and Visiting, will benefit from opportunities to meet face to face and on a closed NCETM discussion forum to discuss approaches, successes and issues.

We will make use of the extensive support facilities available on the NCETM portal as well as a wide range of other resources freely available. The networks will have a range of options open to them and it is envisaged that they will choose approaches that build on their own experiences and are relevant to the circumstances of the particular contexts in which they are working.

Some suggested models could include Lesson Study, developing teaching approaches which encourage active learning and using evidence from other cultural contexts as a provocation for examining current teaching practices.

Throughout the duration of the project, a Project Leader from the NCETM will be available to support the work of the networks and to discuss problems and successes as they arise. It is anticipated the different networks will be able to offer one another considerable support and guidance as the project progresses and the model is one of empowering schools and teachers to help themselves to develop their professional practice in ways that help children to attain arithmetic proficiency.

The Project Leader is Jenni Back. Jenni has worked with networks of teachers all over the country and is an experienced leader and developer of CPD resources and resources for learning and teaching mathematics. She has worked for the NRICH project at Cambridge University, for CIMT at Plymouth University, and is one of the editorial team of the journal for teachers, Primary Mathematics, for the Mathematical Association.

If you would like further information about the project, please contact Jenni Back jenni.back@ncetm.org.uk, copying in Rachel Ball (project administrator) rachel.ball@ncetm.org.uk.
<https://www.ncetm.org.uk/news/38430>

Annexe C: Visits to Host Schools network groups¹⁶

Host School	Input	Number of participants
Eleanor Palmer (Camden School Network Community on Portal)	21 st March 2013 Afternoon CPD session	23
Boasley Cross CP School	5 th February 2013 Demo lesson, meeting on calculation policy	8
Thornhill Primary School	26 th & 27 th February 2013 Observation of study lesson and contribution to lesson study feedback	8
The Wroxham School	14 th March 2013 Joint CPD day with NRICH linking Host Schools project with use of NRICH resources	20 in am 5 in pm
Lakenham Primary School	12 th February 2013 Demo lesson at 2 Visiting Schools, discussion re ways forward with local lead, twilight session for teachers	12
Harleston CofE VA Primary School	13 th February 2013 Diagnostic arithmetic assessment for two groups of children re key thresholds, demo lesson, observation of study lesson and feedback	12
Latchmere Primary School	7 th March 2013 CPD day with teachers from all schools on curriculum proposals, issues in primary arithmetic and resources for teaching primary arithmetic. IRIS connect	16
Northleigh CE Primary School	30 th January 2013 Discussion with HS and VS teachers re issues in teaching arithmetic particularly multiplication and division and demo lesson using MEP resources	6
St Lukes Primary School	17 th January 2013 CPD morning on division and meeting with St Lukes and St Martins in pm re developing a Big Ideas curriculum in arithmetic and developments for the project – resulted in successful CTP application	am 12, pm 2
Shipston on Stour	29 th January 2013 Three VS visits, time with HS lead and then twilight CPD session on learning key facts and other issues in multiplication	15 twilight
Abbey Gates Primary School	12 th February 2013 bservations in morning and CPD in afternoon for all schools involved on exploring approaches to multiplication and division	10
Host School	Input	Number of participants

¹⁶ Taken from Primary Mathematics Host Schools Project Lead report

Host School	Input	Number of participants
Chantry Primary Academy	7 th February 2013 Lesson observations in pm and twilight session on using lesson study approaches to developing problem solving approaches to teaching arithmetic	6
Oakthorpe	22 nd February 2013 CPD session on using rich tasks to support fluency and understanding in arithmetic, supported observations of children engaged in rich tasks and identification of progression and evidence of learning. Development of CTP bid on basis of this work after session.	12
Ripley Endowed Primary School	22 nd January 2013 Two demo lessons on problem solving approaches to teaching arithmetic one in each of the joint lead schools, discussion with both school leads on calculation policy and using artefacts to develop arithmetic proficiency, twilight session on key issues in primary arithmetic and problem solving approaches to teaching arithmetic	25 twilight 2x 3 in schools
Fairlawn Primary	28 th February 2013 Two diagnostic assessment sessions with groups of children, discussion with members of group about calculation policies, and input on issues in teaching primary arithmetic	3
South Green Junior School	14 th February 2013 Day on developing calculation policy and issues in teaching primary arithmetic	5
Lady Joanna Thornhill Primary School	28 th January 2013 Two demo lessons with audience of teachers, TAs and LA advisors, day on issues in teaching multiplication and division in years 3 & 4	25
Great Bowden Academy	12 th November 2012 Discussion with subject leaders at Host School, observation of study lesson and feedback, work on calculation policy, twilight CPD for all schools on Number sense	18
Eardisley CE Primary School	1 st February 2013 CPD comprising 2 lesson observations and feedback, videoed demo lesson with children from all schools, meeting with subject leaders re calculation policy, twilight CPD session on issues raised during the day for parents, teachers and TAs	15, 4, 25
Fleetville Junior School	4 th February 2013 CPD day for all teachers on issues in teaching arithmetic focusing particularly on subtraction with demo lesson on subtraction	15
Ashley Down Primary School	7 th December 2012 Support and contribution to day on addition and subtraction with presentation on models, images and using rich tasks to develop arithmetic proficiency.	40
Thorne Brooke Primary School	24 th January 2013 Input to full day on division, observation and feedback on lesson and discussion about calculation policies	5

Host School	Input	Number of participants
Heversham St Peter's CE Primary	23rd November 2012 Input on sharing resources and Hungarian approaches to teaching arithmetic. Participation in workshop exploring use of Big Mats in arithmetic, developing plans for the rest of the work of the group.	7
Carleton Endowed CE Primary	30th November 2012 Input on teaching arithmetic in Y 3 & 4 and discussion about calculation policy.	5
Benedict Biscop CE Academy	23rd November 2012 Input on teaching arithmetic in Y 3 & 4 and discussion about calculation policy – comparing approaches across the network and sharing resources	20
Highlands Primary School	23rd January 2013 Host school visit and lesson observations, discussion about calculation policy, contribution to afternoon network meeting looking at identifying progression in teaching arithmetic in Y3 & 4	6
Widey Court	6th December 2012 Two lesson observations and feedback, focus on division, twilight discussion about calculation policy across schools and the secondary school which they feed into	7
Hey With Zion	20th March 2013 Two lesson observations and afternoon session on calculation policies	4
Hopping Hill Primary	21st February 2013 Led day on issues in primary arithmetic and developing calculation policy for all schools in network group	6
Totals	29 visits	371

Annexe D: Comparison of beliefs about pedagogy and learning

		Survey 1				Survey 2			
		Necessary	Important	Unimportant	Total	Necessary	Important	Unimportant	Total
Use of practical apparatus such as Numicon, Cuisenaire rods, Dienes apparatus or multilink cubes, bead strings, empty number lines	<i>Frequency</i>	36	176	0	212	28	149	1	178
	Percentage	17	83	0	100	16	84	1	100
Use of resources that use numbers in symbolic form such as place value cards, 100 square, number tracks, numbered number lines	<i>Frequency</i>	39	172	1	212	48	129	1	178
	Percentage	18	81	0	100	27	72	1	100
Opportunities to practise doing pages of routine calculations presented in symbolic form e.g. $3 + 5 =$, $17 - 9 =$, $6 \times 4 =$	<i>Frequency</i>	69	62	76	207	73	41	64	178
	Percentage	33	30	37	100	41	23	36	100
Opportunities to tackle 'word problems' such as 'If Jack has 7 grapes and his Mum gives him 6 more, how many will he have altogether?'	<i>Frequency</i>	58	150	4	212	58	120	0	178
	Percentage	27	71	2	100	33	67	0	100
Opportunities to talk about strategies for solving arithmetic problems and for children to express to one another the meanings that they construct for them	<i>Frequency</i>	27	181	1	209	30	148	0	178
	Percentage	13	87	0	100	17	83	0	100
Opportunities to create problems that require simple arithmetic solutions	<i>Frequency</i>	76	128	7	211	68	107	3	178
	Percentage	36	61	3	100	38	60	2	100
Opportunities to tackle rich accessible tasks that require arithmetic understanding to solve them e.g. Playing the Dotty Six game from the NRICH website	<i>Frequency</i>	37	172	3	212	29	149	0	178
	Percentage	17	81	1	100	16	84	0	100
Opportunities to explore the meaning of the equals symbol as well as comparing quantities and numbers using the < and > signs -	<i>Frequency</i>	81	128	2	211	73	102	3	178
	Percentage	38	61	1	100	41	57	2	100
Opportunities to engage with all kinds of arithmetic statements with different meanings and to examine their truth/validity e.g. $5 - 2 = 7 - 4$, $8 > 5 + 6$, $2 < * < 7 - 2$	<i>Frequency</i>	61	149	2	212	70	102	6	178
	Percentage	29	70	1	100	39	57	3	100
Opportunities to engage with statements in words and to express them in symbolic or iconic form e.g. The number of vehicles is equal to the number of vans plus the number of cars shown to the children with a picture of 2 vans and 3 cars in a car park.	<i>Frequency</i>	65	139	4	208	63	109	6	178
	Percentage	31	67	2	100	35	61	3	100