

‘Assessing the impact and sustainability of networks stimulated and supported by the NCETM’

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1 - EXECUTIVE SUMMARY

A research team from the Institute of Education, University of London¹ carried out a three-month study of the effectiveness and impact of the 185 teacher networks and projects that have been supported by funding from the National Centre for Excellence in the Teaching of Mathematics (NCETM) since 2006. The study addressed the following **research questions**:

- What types of networks and projects were established with the support of NCETM?
- How were these networks and projects established and sustained?
- What outcomes (for teachers, schools and students) can be associated with these networks and projects?
- What factors can be associated with the sustainability and success of the networks and projects?
- How can similar teacher networks be established and sustained in the future?

These questions were investigated through three sequential phases of **research activity**:

- An online survey of the 160 individuals responsible for leading and co-ordinating the networks and projects. Responses were received from 73 leads and co-ordinators - constituting a response rate of 45.6 percent.
- Telephone interviews with a representative sample of 25 leads and co-ordinators.
- Case study visits to eight networks and projects.

The data resulting from these research activities led to a number of **general findings and observations**.

- All of the teachers and professionals responsible for setting up the networks and projects were enthusiastic and committed maths education practitioners – many of whom had been involved previously in professional development activities. As such, the NCETM funding was being used by people who were already active and engaged maths education practitioners. In many cases, the offer of potential funding from an external organisation had provided these individuals with an impetus to pursue group activities that had been tentatively planned but up until that point unrealised. In this sense the NCETM funding programme provided teachers and schools with a valuable external ‘catalyst’ - prompting already well-intentioned individuals and groups of teachers to take action.
- The specific reasons for initiating networks and projects differed across the sample. Whereas some groups were motivated to develop mathematics capacity within their institutions (especially those working in primary schools), others were attracted by the benefits of working with a wider community of like-minded teachers (especially those working in secondary schools). Many of the networks and projects reflected a desire to provide teachers with opportunities to reflect on

¹ The research team comprised Anastasia Gouseti, Richard Noss, John Potter and Neil Selwyn from the Institute of Education’s ‘London Knowledge Lab’.

their professional practice outside of the daily demands and routines of teaching. While these issues and intentions can be seen as common to all subject disciplines, some teachers highlighted the particular need within *mathematics* education for teacher networking and collaboration. One prominent issue in this respect was a perceived insecurity of mathematics teachers in relation to gaps in their subject knowledge and expertise. Here it was argued that mathematics was an area of the curriculum where teachers were expected to have high levels of subject-based competence and expertise. In this respect, it was felt that mathematics teachers were often reluctant to seek assistance, advice and help from others.

- Most of the networks and projects were organised around sets of face-to-face meetings and sessions – with groups taking flexible and pragmatic approaches to organisation and delivery. One characteristic of successful networks and projects was the ability for groups to ‘organically’ become more self-directive over time. Many of the networks were described as being organised in a far less formal manner than other professional development and collegial activities. In many cases, the most valued activities and outcomes of the projects and networks were the informal social interactions between participants.
- The successful running of the networks was dependent on a number of factors – especially the continued efforts and energy of the co-ordinating and lead teachers. Other important factors included the interest and engagement of participating teachers, and the general endorsement of senior leaders and managers. The prominent organisational constraint for most – if not all - of the networks and projects related to issues of time. Many participants faced the challenge of finding mutually convenient times in the school day for teachers to meet, and having to work around the varying pressures of the school calendar year (especially the restrictions of schools’ examination and assessment schedules).
- One of the most prevalent enabling factors identified by the lead and coordinating teachers was the contribution of the NCETM funding. From a practical perspective, the funding constituted a small but necessary financial contribution to the projects and networks. Grants were used to purchase resources and administrative support, hire rooms, ‘buy-in’ external consultants and speakers and - above all - ‘buy-out’ the time of participating teachers. However the NCETM funding was also significant in symbolic terms. Lead and co-ordinating teachers described a heightened status and kudos that their projects were afforded within schools and colleges as a result of being awarded external funding from a national organisation.
- One surprising finding from the research data was the relatively limited use of technology-based forms of communication and collaboration. This lack of technology use by many groups was often justified as stemming from teachers’ time constraints and the difficulty of ‘committing’ to network activities outside of the set meetings. In many cases, digital technology was not felt to be a necessary element of the network and project activities.
- All but three of the surveyed leads judged their project to have been ‘successful’ in terms of achieving its aims *and* in terms of being ‘useful’ to participating teachers. In fact the majority of leads (particularly those in secondary education and/or those groups running from 2009 onwards) reported that their network or project had been ‘very successful’ in achieving its original aims, and had been

'very useful' to the majority of teachers who participated. This latter finding was particularly noticeable in smaller networks of less than ten teachers and/or those groups that had run from 2009 onwards. Amidst these general perceptions of success, there was a notable tendency for respondents to value the less 'formal' outcomes of their activities such as *'encouraging teachers to incorporate new ideas into their own teaching preparation and planning'* and *'allowing teachers to engage with colleagues/peers that they would have not otherwise collaborated with'*. Conversely, issues of subject knowledge and increased access to resources were relatively less likely to be seen as 'very successful' outcomes.

- Some of the most highly-valued outcomes of the networks and projects involved personal development. There was a clear sense of professional development and growth for the individual lead and co-ordinating teachers. As far as many leads were concerned, participating teachers had also benefitted from the opportunity to move outside of their day-to-day working lives (albeit on a temporary basis) and reflect on their role as mathematics educators and the wider nature of mathematics education. This sense of increased self-awareness and expansion of attitude was described by some teachers in terms of altered pedagogic practice, improvements in pupil motivation and abilities, and a general shift in the 'ethos' of some schools towards mathematics education.
- A minority of leads and participating teachers had continued their activities after the official funding period had elapsed. There were often projects and networks that had been relatively well established over a number of years. Yet in many cases, the discrete nature of the network activities meant that groups had not continued any formal contact or collaboration after the duration of the funded activity. In these instances the longer-term legacy of the networks was felt to be experienced in the ongoing changes in teacher practices that were resulting from the earlier 'official' network activities.

On the basis of these findings and observations a number of **conclusions and recommendations** are reached.

- First and foremost, it can be concluded that the networks and projects covered in this study were all successful examples of teacher networking and learning communities. The networks and projects appeared to be of considerable benefit to many participating teachers, and were perceived widely to have led to a range of positive enhancements and changes in terms of individual practice and school-wide activities. There is clearly a benefit in supporting teacher networks and community activities in mathematics education.
- This research set out to assess the impact of networks stimulated and supported by the NCETM. One of the research questions defined at the outset was "What outcomes (for teachers, students, schools and colleges) can be associated with these networks and projects?" The research data shows that a principal outcome of the NCETM funded projects programme has been the formation of "professional learning communities", capable of promoting and sustaining the learning of all professionals in the school, with the collective purpose of enhancing pupil learning. The funding programme has, therefore, had a positive impact and achieved its aims. Throughout this report, teachers' engagement with their professional development, through the formation of professional communities, facilitating the enhancement of mathematical knowledge, should be interpreted as positive impact of the programme.

- It must be recognised, however, that the success of many of the NCETM-funded groups was linked to the finite nature of the network and project activities. Although there were some examples of continued activities being pursued after the network and projects were completed, most groups worked well because they ran for a limited period of time. Given the pressures of time faced by many teachers and schools this is perhaps to be expected. As such the long-term benefits of the network/project activities were most often seen by the participants to be sustained in the form of individual teacher practices and informal collaborations.
- One key point for further action relates to the significance of the modest amounts of funding provided by NCETM. While many of the group activities could have been run using internal school funds, there were clear benefits of having an external organisation such as the NCETM providing funding. The NCETM also provided a valuable source of external recognition and validation through the coordination of external conferences, accreditation and award schemes. In all these instances, there would appear to be a distinct 'added-value' of an external independent organisation supporting the activities that take place in individual schools and colleges.
- The role of the 'leading' and 'co-ordinating' teachers was fundamental to the success of the networks and projects. Many of the projects were clearly dependent on the sustained enthusiasm, goodwill and energy of the lead and co-ordinating teachers. While there is no pressing need for teachers who assume this role to be formally compensated for their work, any attempts to support future projects/networks should consider how lead and co-ordinating teachers may be supported – especially in terms of developing the organisational and inter-personal skills-sets required to successfully guide groups of teachers.
- A further point for action concerns the apparent need to support maths teachers in thinking and talking further about issues relating to their (lack of) subject knowledge. This is particularly the case in terms of addressing shortfalls in subject-expertise and awareness – issues that may not usually or easily be addressed within conventional CPD provision. It could be desirable, for example, for intentionally informal group activities to be supported that can provide teachers with the opportunity to meet and discuss openly their misunderstandings and gaps in mathematical knowledge.
- A final point for consideration is the role of ICT in supporting the activities associated with the networks and projects. While many teachers were clearly making use of online resources (especially those provided by the NCETM) during their everyday practice, this study found a marked preference for teachers to work together in face-to-face contexts throughout the duration of their networks and projects. While there were some instances of innovative technology use, in general the group-related use of ICT resources was minimal. Any future teacher networking/community programmes should maintain a focus on supporting teachers to meet and work together in face-to-face contexts. Where technology use is encouraged, there may be scope to focus on the 'bottom-up' development of ICT tools and applications within the individual groups alongside the currently centrally provided community functions. For example, informal teacher communication and collaboration may well benefit from groups' adapted use of existing applications such as Facebook, Twitter, Google Groups and Wikimedia alongside 'official' online spaces."

2 - FULL REPORT

2.1. Background & research questions

The concept of 'networked learning communities' of teachers is a relatively recent aspect of professional development in education that is growing in popularity. The notion of supporting teachers to work together in professional networks and communities is now seen as a potentially dynamic and engaging means of enabling the development of a wide range of skills, knowledge and understanding (Muijs *et al.* 2011). Often these networks are developed within individual schools and colleges. Alternatively, communities of teachers across different institutions are established. In both senses, such networks have been found to increase teacher learning in terms of subject-specific and pedagogic knowledge and skills, to strengthen motivation, and encourage teachers to actively try out new practices (Kerr *et al.* 2003). Studies in the US also point to the social and emotional aspects of successful networks – building collegiality amongst groups of like-minded peers (Firestone and Pennell 1997). These networks and communities have also been found to support teachers' efforts to modify their teaching practices. Successful networks are therefore argued to lead to a combination of personal and professional, social and work-related benefits (Niesz, 2007; Pennell and Firestone, 1996).

A number of different attempts have been made over the past ten years to enable the creation of teacher networks in English schools and colleges. The Department for Education in conjunction with other educational organisations and professionals produced a range of resources during the 2000s to support the development of teacher networks and 'professional learning communities' within schools. Here a working definition was used of any group of teachers and other professionals with 'the capacity to promote and sustain the learning of all professionals in the school community with the collective purpose of enhancing pupil learning' (Stoll *et al.* 2006, n.p.). This official description encompasses a number of common characteristics – i.e. all community members having shared values and a shared vision; teachers taking collaborative responsibility for pupils' learning; a focus on reflective professional enquiry; group collaboration; as well as individual professional learning. These characteristics – and others like them – have therefore formed the basis of networks across a range of subject areas and phases of UK education.

Against this background, the National Centre for Excellence in the Teaching of Mathematics (NCETM) has been involved in a sustained programme of funding the development of teacher networks in the area of mathematics education. Since the launch of its funding programme in 2006, NCETM has supported and stimulated a wide range of teacher groups, totalling 185 separate networks and projects. These have included the formation of professional learning communities, as well as group-based collaborative investigations and action research projects. While the nature and form of these networks and projects has varied, there has been a common focus on enhancing 'mathematical knowledge'. This includes knowledge of specific mathematics content; mathematics-specific pedagogy; and knowledge of how to embed these in teaching practice.

These NCETM networks and projects constitute an extensive and varied range of teacher groups. The aim of the present study was to evaluate how the NCETM networks and projects have been implemented in practice. In so doing, an additional element of the evaluation was to explore what - if anything - is special about the mathematical focus of the networks in question. Against this background the evaluation addressed the following research questions:

- What types of networks and projects were established with the support of NCETM?
- How were these networks and projects established and sustained?
- What outcomes (for teachers, students, schools and colleges) can be associated with these networks and projects?
- What factors can be associated with the sustainability and success of the networks and projects?
- How can similar teacher networks be established and sustained in the future?

2.2. Research methods

These research questions were addressed through three phases of research activity².

- **An online survey of all leads and coordinators.** An online survey was developed for the 160 named leads of the funded NCETM networks and projects. The survey was hosted between late December 2010 until the end of January 2011. Responses were received from 73 leads – a response rate of 45.6 percent.
- **Telephone interviews with a representative sample of leads and coordinators.** In-depth semi-structured telephone interviews were then held with a representative range of 25 network leads from the middle of January 2011 until the end of February 2011. These telephone interviews were conducted with network leads who had completed surveys and covered an indicative range of networks and projects.
- **Case study visits to eight NCETM networks.** Finally, eight ‘network case study’ visits were made during January and February 2011 to further explore issues emerging from the previous elements of the study.

² For a full description of research methods and sampling, please refer to Appendix Two.

2.3. Research findings

i) How the networks were initiated

The networks and projects had been set up by a range of teachers and professionals from a variety of institutional backgrounds. Perhaps understandably, all of the teachers who participated in the study were enthusiastic and committed maths education practitioners – many of whom had been previously involved in professional development activities. As such these were people who were already active and engaged maths education practitioners – with many working in lead, co-coordinator and advisory capacities in schools and local authorities. Some leads were pursuing extraneous mathematics education activities such as PhD or Masters studies, small-scale professional development projects and other teaching and learning initiatives. While some of the leads had previously been involved in NCETM-related activities (as one interviewee put it, *'I was a known name to the NCETM' [#1, PR, NW]*)³, others had been working on collaborative projects and initiatives outside of the National Centre. Thus in many cases, the offer of potential funding from the NCETM provided a focus – and in some cases an impetus – to pursue activities and intentions that had already been established in embryonic form. Prior to applying to the NCETM for funding, some interviewees had already developed informal networks of *'like-minded colleagues'* [#10, CX, E] or a *'family'* of schools [#1, PR, NW] with whom contact had already been made. In this way the basis for the group activities was often already established prior to the application for funding. As these interviewees described:

'We were already planning to do a lot of work at school before we got the funding...the funding made what I wanted to achieve much more easy to achieve' [#2, PR, NW]

'I had met other like-minded colleagues during a conference from different geographic areas and we had already thought that some sort of network would be a really fabulous way of keeping up contact with one another while developing that particular area of mathematics' [#10, CX, E]

The NCETM funding programme can therefore be seen as providing an external 'catalyst' - prompting individuals and groups of teachers who were already well-intentioned to take action. This sense of impetus was illustrated in the case of one lead who had only come across the NCETM website on the day before the deadline for submission:

'We'd been trying to find some money to support a lesson study learning network in our school in maths and it fitted the bill. It was almost like destiny!' [#12, PR, EM]

³ All of the direct quotations from interviews have been tagged with the following respondent details: **interview number** (1 to 25); **phase** (PR – primary, SE – secondary, PS – post-16, CX – cross sector) and **region** (E - East of England, EM - East Midlands, LN – London, NE - North East, NW - North West, SE - South East, SW - South West, WM - West Midlands, YH - Yorkshire and the Humber).

Beyond this serendipitous example, other leads had taken a more planned approach – having been encouraged to apply by senior managers, other colleagues and (in a few instances) directly by NCETM regional co-ordinators. Some reported having responded to online calls and newsletter/newspaper advertisements. Throughout all of the interviews there was a recurring sense of the enabling nature of the offer of external funding. As one lead who had previously ‘given up’ on their plans for running a CPD project put it, the NCETM funding provided an opportunity to ‘*put these two ideas together*’ [#6, PR, SW].

ii) Reasons for initiating the networks

The stated reasons for initiating a network or project differed across the survey sample - reflecting the varied nature of the projects and networks (see Table 1). Whereas some teachers were motivated to develop mathematics capacity within their school or college, others were attracted by the prospect of working with a community of teachers. Within the survey data, two specific differences were apparent. Firstly, the motivation of wanting to develop mathematics capacity was most likely to be mentioned by the leads of primary education groups (14 of the 19 network/projects dealing only with primary teachers). Conversely, the motivation of wanting to get involved in a professional community was most likely to be the case for groups of secondary school educators (17 of the 27 secondary school network/projects).

	Per cent	n
I / we wanted to develop mathematics capacity within our own institution	59	43
I / we wanted to get involved in a professional community	53	38
I /we wanted to win an external grant/funding	37	27
I / we wanted to do action research	29	21
I wanted to develop experience of leading a project	26	19

Table 1. Stated reasons for initiating the networks/projects

Reflecting these different motivations, the networks and projects all involved a diverse range of specific topics and activities. In particular, the survey data highlighted two main areas of general interest, i.e.: supporting and improving teachers’ pedagogy and/or supporting and improving teachers’ practice (see Table 2). This trend was consistent across all phases and all types of project. Indeed, the only notable difference was in terms of a focus on ‘subject knowledge’ (defined in the survey as ‘supporting teachers to talk about mathematical knowledge and skills’). This was a stated priority for the majority of projects covering primary, post-16 and cross-sector phases, but only a priority for a minority of projects at secondary level (where subject knowledge was a reported priority by one-third of leads – i.e. 10 from 27).

	Per cent	n
Supporting teachers to talk about how pupil/student learning of maths can be enabled and supported – i.e. pedagogy	85	61
Supporting teachers to talk about how to apply these ideas in practical classroom situations – i.e. classroom practice	84	60
Helping teachers to share/recommend existing teaching resources	57	41
Supporting teachers to talk about mathematical knowledge and skills – i.e. subject knowledge	56	40
Helping teachers to create/produce new teaching resources	55	40
Helping teachers to research their own classroom practice	45	33
Helping teachers to develop new schemes of work	15	11
Supporting teachers to talk about topics not related to mathematics education	6	4

Table 2. Stated aims for the networks/projects

These patterns were explored further in the interviews. In terms of their intentions, motivations and aims, there was a shared sense of interviewees wanting to work to improve mathematics education and to support mathematics teachers. While some interviewees conveyed an evangelical approach towards their activities (one lead described her ambition of helping teachers become mathematics ‘ambassadors’ who would ‘go back to their schools and really change what is going on’ [#14, SE, NW]) all were enthusiastic about making a positive contribution to mathematics education. One key theme that emerged from many of the groups was a desire to provide teachers with additional time and space outside of the daily demands and routines of teaching to reflect on their subject area and professional practice:

‘We wanted to learn a little bit about more modern day pedagogical practices and just to have an opportunity to really chat with other practitioners’ [#3, CX, WM]

‘The aim of our network was to just work on whatever the teachers wanted to work on, to listen to them, to give them a chance to talk and to say what it was that they would like to explore more’ [#8, SE, NW]

There were some clear differences in these aims and motivations according to the different phases of education. In particular those leads and teachers working in primary education often focused on affective outcomes in their stated rationales and aims. As this lead of a primary school network described:

‘There’s a lot of insecurity among primary teachers in the teaching of mathematics, lots of teachers don’t feel confident about the teaching of mathematics and allowing people to work together and just support each other with no threat with nobody looking over your shoulder judging what you’re doing is really valuable’ [#12, PR, EM]

While conveying a similarly enthusiastic tone, those teachers working in secondary schools and colleges tended to emphasise different sets of motivations and aims - often focusing on targeted issues of raising standards and improving outcomes through distinct areas of the curriculum such as ICT, new forms of assessment, specific learning techniques and so on. Indeed, the interview sample included an impressive breadth of specific activities and approaches to mathematics education in secondary school – which may have otherwise been left on the periphery of current day-to-day practice.

It should be noted that these differences in motivation and intention were not always sector-specific. In one network the need for meeting and support was felt to stem from the relative youth and inexperience of a group of teachers across a cluster of schools - *'the majority of participants are young and new teachers and they needed the support the network gave them'* [#20, PS, YH]. Conversely, another network brought together subject leaders who, despite being well connected with other maths teachers, felt relatively isolated from other maths leaders. The focus of this project was therefore specifically directed towards *'working together at middle leader level to look at how you could deliver maths differently'* [#1, PR, NW].

While many leads felt that the issues and intentions addressed by their networks and projects were common to all subject disciplines, some did highlight a particular need within *mathematics* education for teacher networking and collaboration. Prominent issues in this respect included the emphasis throughout mathematics teaching on testing and external assessment. As one lead of a secondary school network reflected, *'the culture surrounding maths education is one of testing and measuring and what happens is that teachers just don't get much of an opportunity to talk about other practices without having somebody with an external agenda to lead that discussion'* [#9, SE, SE].

Perhaps the most common theme in this respect was a perceived insecurity of mathematics teachers with regards to their subject knowledge and expertise. Here it was argued by some teachers that mathematics was an area of the curriculum that fostered heightened expectations of subject-based competence and expertise. In this respect, it was felt that mathematics teachers perhaps experienced a particular reticence to seek assistance, advice and help from others:

'Mathematicians are particularly sensitive about subject content. So if you are a maths teacher you are supposed to be a subject expert and it takes quite a lot of great will to stand up and say "you know I have no idea why tangent is called tangent"' [#11, PS, LN]

'There are lots of views about maths that make it difficult sometimes, people see it as a right or wrong subject which sometimes means you wouldn't talk about things because people assume that people who teach maths are clever and so there is a bit of pressure on you to feel like you can do something without asking for help I guess which means that perhaps having a network which is open and everyone's equal makes it easier for people to say "I'm finding this hard, what would you do with this?"' [#24, SE, SE]

'I think networking can be used in any subject but I think in maths because subject knowledge of teachers is so varied I think sometimes teachers who aren't confident with their maths need, you know, if you don't understand something in English or Geography you read about it and understand it. In Maths sometimes it's hard to learn just by reading at something and then

trying to teach somebody about that. So I think the network idea is good to help less confident teachers in mathematics’ [#22, PR, EM]

iii) How the networks operated

	Per cent	n
A series of scheduled meetings/ sessions	90	65
Informal exchanges and conversations (face-to-face)	56	42
The production of a publication/ report	43	31
The production of teaching/learning resources	41	30
Email discussions	32	23
The planning and carrying out of a research project/ enquiry	30	22
Discussions through NCETM forums/ communities	23	17
Discussions through other online forums/ communities	6	4

Table 3. Types of network/project activities

As can be seen in table 3, the networks and projects took a variety of operational forms. Most were organised around series of face-to-face meetings or sessions coupled with informal face-to-face exchanges. In practice these arrangements had taken place in a flexible and variable manner according to the circumstances of the group. While many networks were designed to be run through a regular pattern of meetings, often in practice the nature and timing of the meetings were altered to accommodate changing circumstances and variations in the school year. In one instance, twilight sessions had been introduced during the middle of a programme of planned daytime meetings *‘just to give the teachers a chance for a breather’* [#21, CX, SE]. In this sense, many of the networks were described as being sustained through a flexible and pragmatic approach to organisation and delivery. As this network lead explained:

‘A lot of face to face meetings, we used some emails, we had evening meetings, we had a couple of afternoon meetings and people also would talk to each other and that didn’t involve me at all...so it was quite informal’ [#4, CX, YH]

One surprising finding from both the survey and the interviews was the relatively limited use of technology-based forms of communication and collaboration. While many teachers were clearly making use of online resources (especially those provided by the NCETM) during their everyday practice, this study found a marked

preference for teachers to work together during their networks and projects in face-to-face contexts. For example, only two of the interviewed group coordinators reported that their network made extensive use of the online 'community' spaces. In these cases, the sharing of videos, lesson plans and other resources was felt to be an integral element of the network's success. As the leads described:

'We did keep contact a lot through the Community, so that was really valuable, that was probably the most valuable thing for us' [#10, CX, E]

'I would say that the online group...the community that was really helpful and it was a really useful place you know to dump documents and sorts so that everybody could access them – that was a real enabler actually' [#21, CX, SE]

There was some evidence of other forms of ICT being used during the group activities – although this was not a consistent feature of most projects and networks. For example, some leads had used 'email follow-ups on what people had thought about between the meetings' [#8, SE, NW] and, in one instance, self-authored blogs had been used to 'stimulate between-session discussion' amongst other network participants [#6, PR, SW]. However, for the majority of groups, online opportunities for communication and collaboration were reported as being under-utilised. This lack of technology use was sometimes justified as due to the restricted nature of participants' time and the groups' ability to 'commit' to network activities outside of the set meetings. Some interviewees described the convivial and communal benefits of meeting face-to-face. In many cases, then, technology was simply seen by participants as not being an integral element of their particular networking activities. As this lead of a primary network reflected:

'It was very difficult, there were issues of getting people registered on the NCETM website...issues with people finding the time to do the network aspect of it and the commitment wasn't strong to engage in online discussion, they were happy to go away and do the work and meet again face to face but they weren't keen on linking up through the portal' [#1, PR, NW]

iv) What did the networks do?

These issues of flexibility and adaptability were also reflected in the nature and focus of the network and project activities. While many of the networks – especially at secondary and post-16 levels – were based around specific topics and activities, one recurring feature highlighted as underpinning the success of networks was a sense of pragmatism and flexibility of interest. For example, the lead of one group that was ostensibly focused tightly on a specific area of subject knowledge development described how their initial planning and structuring approach to running the network was tempered by the tendency as time passed for the group to 'organically' become more self-directive: *'it was top-down at the organizational stage but what actually then happened in the meetings was far more organic' [#14, SE, NW]*. This notion of the 'empowering' [#21, CX, SE] nature of 'evolving' [#11, PS, LN] group-directed activities and self-management was stressed in a number of interviews.

Many of the interviewees raised the importance of ensuring a degree of teacher involvement and leadership in the networks and projects - *'these projects only work if*

people have the opportunity to get involved' [#9, SE, SE]. While some leads had taken a deliberately contingent approach from the start of the network (*'it's just developed as it's gone along'* [#20, PS, YM], *'we normally planned one meeting ahead'* [#8, SE, NW]), others had found themselves able unexpectedly to reduce the level of central direction as the group became more cohesive and confident. As one lead described: *'it's turned out to a bit like a spider's web really, it started at the centre and then it goes out. As time goes on they then have taken responsibility for it themselves'* [#13, PR, LN].

Indeed, many of the networks were described as being run along less formal lines than other professional development or collegial meeting activities. Some leads suggested that this relatively informal approach perhaps stemmed from the 'extra-curricular' nature of their network activities, while also reflecting the collegiality of the participating teachers:

'It was a flexible approach, the reason for that obviously is that because we've got a lot of professional people I didn't want to at any point insist that they use certain things. I wanted them to feel part of it and to feel that they were contributing rather than being imposed upon' [#3, CX, WM]

'The group sort of led themselves rather than dropping things in. They found the focus themselves on what they wanted to do and what they wanted to know was how things were in different departments. So they were making sure we got progression' [#4, CX, YH]

In many cases this flexible approach had prompted a gradual shift away from initial intentions and stated aims towards sets of unintended but sometimes 'more interesting' activities [#23, CX, SE]. In particular, one of the most valued activities and outcomes reported in the interviews were informal social interactions between participants – with teachers benefitting from opportunities to 'gossip', 'catch-up' and socialise with each other:

'You need to make sure that every meeting has time for the teachers just to gossip for whatever is on their mind because that's an important part of them giving up their time. They need time to download as well as making sure that you involved them as much as possible in determining the course of what happens in the meetings' [#8, SE, NW]

Most of the networks and projects were nevertheless reported to have progressed as expected. As one lead put it, *'we never planned it rigidly, you know, we always allowed for the unexpected...so I would say overall it all ran smoothly'* [#5, CX, NW]. Of course, groups had experienced a number of different challenges throughout the duration of their network – not least teacher absences, changes in personnel, curriculum reorganisation, changing commitment of schools' senior management teams, and the fluctuating demands of the school year. As one lead described, their network could therefore be said to have 'ran smoothly in patches':

'It ran smoothly in patches, yeah, I would say that, if Christmas is coming things tend to relax because Christmas gets in the road, you know, you've got Christmas markets, Christmas performances so teaching goes out of the window a little bit but we didn't particularly have any unexpected lapses' [#4, CX, YH]

Although generally reluctant to self-aggrandise, some interviewees were keen to stress the additional (and often unseen) work required on the part of the network leads and co-ordinators in maintaining even the most unplanned and self-directed of projects and networks. This work was often described as involving a dogged approach to ‘*keeping nagging people until we could get everybody together*’ [#4, CX, YH] as well as attending to ‘*the boring organizational nitty-gritty - who’s bringing the refreshments? Who’s organizing this, who’s organizing that?*’ [#10, CX, E].

v) Factors underpinning the successful running of the networks

While a range of factors were identified by survey respondents as being important to the success of the networks and projects, the main issues highlighted were teachers’ interest and engagement, the commitment of the network/project leads and the presence of the NCETM funding itself (see Tables 4 and 5).

	Per cent	n
The interest and/or commitment of other members of the network/project	88	51
My own personal commitment to facilitating and leading the network/project	86	49
The financial support of the NCETM award	77	44
My own personal enthusiasm in facilitating and leading the network/project	74	42
My own personal organisational skills in facilitating and leading the network/project	63	36
Having a clear focus on certain subject areas, teaching methods, or approaches to enhancing professional development	59	34
My own personal leadership skills in facilitating/leading the network/project	54	31
Having a variety of activities that gave teachers flexibility in what they covered	53	31
Having support and commitment from senior leaders/ managers in my own institution	29	17
Support and advice from the central NCETM office/ team	16	9

Table 4. Factors perceived as important to the eventual success of the network/project (in response to the question: How important were the following issues relating to the nature of the network/project?). Data are numbers/percent of respondents reporting the factor as being ‘very important’

	Per cent	n
Teachers feeling interested in the activities/topics	94	59
Teachers feeling that the activities and topics were relevant to their own teaching	94	59
Teachers feeling motivated to engage in the activities/topics	92	57
Teachers having enough time during the school/college day to participate in the network/project activities	75	47
Teachers having enough time outside of school/college to participate in the network/project activities	75	47
Teachers having the freedom to alter the nature of the network/project to fit the group's interests and needs	56	35
Teachers feeling that the activities and topics matched their own beliefs about teaching	51	32
Teachers having the opportunity to share leadership of the network/project, and decide on the nature of the activities	48	28
Teachers 'getting on with' the other participants in the network/project	37	23

Table 5. Teacher-related factors perceived as important to the eventual success of the network/project (in response to the question: How important were the following issues relating to the nature of the network/project? Data are numbers/percent of respondents reporting the factor as being 'very important')

These issues were also raised in many of the interviews. Indeed, when interviewed, network leads were able to identify a number of key factors and issues that supported (or sometimes hindered) the practical operation of their networks and projects. Perhaps the most prevalent factor raised was the contribution of the NCETM funding. From a practical perspective, the funding provided a small but necessary financial contribution to many of the projects and networks – enabling the purchasing of resources and administrative support, the hiring of rooms, buying time from external consultants and speakers and so on. Some interviewees described the funding as being particularly welcome in terms of allowing the purchasing of 'extraneous' items (such as tea, biscuits, cakes and petrol money). These were items that were not seen as being essential to the running of the networks, but nevertheless generated a sense of goodwill and enthusiasm amongst participants.

That said, many interviewees concurred that the most valuable aspect of the funding was the ability to 'buy-out' the participants' time. Indeed, the ability to pay for participants' full involvement was a recurring theme across the projects and networks – highlighting the overall importance of 'teacher time' (an issue that is further discussed in proceeding sections of this report). As these two interviewees described:

'To get busy people together is hard... so without the money it would never have happened because people wouldn't have done it. They would have said "we are too busy, we are not very interested" [#19, PR, EM]

'I did find that the funding was extremely useful because that allowed us to open up time during the day rather than waiting for everything to be at night time when people are tired and want to get off, you know what it's like. Having that funding meant we could offer people time within the school day which is extremely useful and valuable' [#4, CX, YH]

Another significant issue for some networks was the symbolic nature of being awarded a grant. Interviewees described the heightened status and kudos that their projects were afforded within their schools and colleges because of being awarded external funding from a national organisation:

'NCETM funding was hugely valuable but the really big thing was that it meant we had a name for the project, we had status within the schools and we had a reason for meetings...and that was really good and really big and really important' [#16, CX, E]

Some interviewees were also quick to praise the supporting role of the wider NCETM infrastructure. Again, the significance of having external representatives involved in school-based meetings was reported as adding 'value' to the activities – both in the eyes of the participants themselves and in the eyes of their school leaders and managers - *'I think if you can have someone from the NCETM at your meeting, it does give a certain value to it'* [#4, CX, YH]. Indeed, the assistance of NCETM regional co-ordinators and staff was cited by some interviewees as a source of considerable practical as well as symbolic support – as one network lead reflected, *'the NCETM person who was our regional advisor I suppose she was extremely helpful in getting the practical side set up ... that was a real enabler actually'* [#21, CX, SE]. While the reporting requirements and deadlines associated with the grants were sometimes described by leads as a source of inconvenience and concern at the time (*'you always have got a milestone to meet'* [#2, PR, NW]), others reflected back on the exhortative nature of having these wider expectations and demands:

'The NCETM has been great at prodding me, you know "come on, get on with it" cause I'm busy with lots of things ... Just having that poke and that prod from the NCETM makes you get on with it to be honest' [#13, PR, LN]

As much of the discussion so far has illustrated, the over-riding organisational factor in most - if not all - of the networks and projects related to issues of time. As one lead reflected, *'the main issue is time ... as always'* [#10, CX, E]. Interviewees' descriptions ranged from the difficulties of finding mutually convenient times in the school day for teachers to meet, to the varying pressures of the school calendar year (especially in terms of the restrictions of schools' examination and assessment schedules). Many interviewees bemoaned the general paucity of free time available to working teachers. Being aware of the pressures of 'teacher time' and building network and project activities around the time constraints of the school was therefore felt to be of paramount importance – a process of *'constant negotiation'* [#2, PR, NW] as one interviewee put it. As these two leads elaborated:

'The biggest thing was that we had money – money to allow people to have some time...Working people are really busy and if you ask them to do something extra, you need to provide a way for them to do that. So you need to give them some time ... It was easy for people to join in because they had already been given time away from their classes and it was organized for them. So that was easy' [#19, PR, EM]

'The greatest hindrance is that the classroom teacher is just snowed under and therefore to make that bit of time and space, you know on a wet January night and, in-between the wet January night and the wet March night to actually do the work in the classroom, they do have to be quite motivated. I've

been really pleasantly surprised that they can overcome that. There's a huge demand of their time. The main thing is the pressure of the exam system, it's constant ... it never goes away' [#11, PS, LN]

Other significant issues raised in the interviews centred on the importance of the participants' roles and interpersonal relationships. As with any group activity, the importance of dynamics and 'group bonding' [#10, CX, E] was described as integral to the success of the networks and projects. As one lead described, the outlook and attitude of participants was often a compensation for any logistical and organisational constraints - *'the fact that the teachers were motivated, interested and fabulous was the counter-balance to the other issues, that's why people came, they loved it'* [#8, SE, NW]. Similarly, the interpersonal demands of the lead and coordinator role was also raised – although mostly in terms of managing and administering the logistics of group activities, as opposed to any subject-related leading and directing. Interviewees were keen to play down their part in the substantive success of the networks, while acknowledging the need for the networks and projects to have committed individuals who were responsible for organisational aspects. As such, the role of the lead was not always described in wholly positive terms - *'It was a lot of work! I don't think for me personally there were many gains, it was mostly lots of hard work on top of a lot of other hard work that I have to do ... but I don't regret having done it'* [#1, PR, NW]. Indeed, the role of the lead was often described as involving a great deal of emotional labour alongside administrative acumen. Interviewees described having to ensure that they maintained *'a sort of fun, enjoyable feeling to get people turn up'* [#11, PS, LN]. While this energy and impetus often came collectively from within the groups, the role of the lead as always having to be on hand to provide *'a bit of a spark'* was acknowledged as being crucial:

'People need to be listened to. It does need an administrative leader but it has to be a facilitator rather than a 'dictator leader'. So it needs someone to put that energy in. And it needs a bit of a spark, you've got to have some really inspirational characters in the network ... especially people who know how to make you dig sideways when you're there and really make you come away from the sessions knowing that you think slightly different now to how you did before, that you've been properly engaged rather than you've been led to that' [#8, SE, NW]

A final factor highlighted in the interviews was the support and endorsement of senior managers and leaders from within the participating schools. Some networks had encountered difficulties in terms of ensuring senior management commitment to continuous teacher cover within some schools. Other networks and projects had suffered from fluctuating levels of commitment from senior leaders to mathematics as a curriculum priority. Interviewees (even those who were head-teachers themselves) therefore described the importance of securing the general support and goodwill of school leaders and senior management – while also discouraging any excessive interference:

'I think having the support of the Head teacher was useful because everybody knew he was keen for it and that sort of gives it added value, doesn't it?' [#20, PS, YM]

'You have to get the senior management on board. But then on the other hand although we did think at the time that we had them on board, it seems like the senior management want to do things only if they initiate them. They

do not like it if staff take the initiative to do things out of their own accord. They want to be the owners of everything that goes on in school. You need to analyse what the leadership style of your school is ... and if it's an undemocratic sort of style then maybe you should rather go across the borough and involve other schools as well and not just work in your own school' [#18, SE, SE]

This need for unobtrusive support from senior leaders and managers perhaps explains the relatively low ranking in the survey of *'having support and commitment from senior leaders/ managers in my own institution'*. While senior leaders and managers were often not responsible for actively driving the development of projects and networks, their support would nevertheless appear to be important.

This issue of tacit support rather than active involvement may also account for the relatively low ranking in the survey of *'support and advice from the central NCETM office/ team'*. This was illustrated in the interviews, where only a few leads reported having to rely on NCETM staff and services for direct support throughout the duration of their networks. For example, a number of leads mentioned receiving advice from their NCETM regional coordinator at the first stages of writing the proposal or setting up online discussion groups. As the leads described:

'I spoke to my Head teacher and we put a bid in for like a national grant but we didn't get it, this was quite a few years ago but through that I got to know [...] my regional project coordinator and he came into school and met with myself and the Head teacher and talked to us about where we had gone wrong putting our bid in' [#25, PR, SW]

'She [NCETM regional coordinator] kind of helped me with my initial proposal for the funding and since then she has come in to my school and kind of helped with the group discussions' [#17, CX, LN]

For other interviewees, however, the value of the NCETM central office/staff was the *'insurance'* that it offered in case direct advice and support was required. That said, the majority of projects appeared to be successful enough to cope without any other form of support. One interviewee did, however, acknowledge how important the support he got from the NCETM portal was for the success of the projects:

'The portal NCETM has been invaluable, you know, the support staff, and help has been invaluable in a successful delivery of all four projects' [#5, CX, NW]

vi) The outcomes and sustainability of the networks

Of course, all indication of the perceived success of the projects has to be seen in light of the self-selecting nature of the sample. This caveat notwithstanding, all but three of the leads responding to the survey judged their project to have been *'successful'* in achieving its aims *and* is being *'useful'* to participating teachers. In fact the majority of leads (31 respondents, 53 percent of respondents giving an answer) reported that the network/project had been *'very successful'* in achieving its original aims. The same number (31 respondents, 55 percent of respondents giving an answer) reported that the network/project had been *'very useful'* to the majority of

participating teachers.

Within these overall perceptions of success a few notable differences were evident. For instance, projects that had focused on secondary phases of education were more likely than others to be considered to have been ‘very successful’ (15 responses from a possible 24). Similarly, projects that were relatively small (i.e. involving less than ten teachers) were also more likely to report that the project had been very useful to teachers (19/38) than projects with ten or more teachers (12/29). There was also a difference in perceived success and usefulness in terms of timing – with projects and networks that had been active in more recent years (i.e. 2009-2011), more likely to be reported as ‘very successful’ than those active in 2008 and before. Whether or not this trend was due to a ‘recency effect’ is not certain from these data.

Also notable was a tendency for respondents to rate the most successful aspects of the networks and projects as being less formal outcomes such as ‘encouraging teachers to incorporate new ideas into their own teaching preparation and planning’, ‘allowing teachers to engage with colleagues/peers that they would have not otherwise collaborated with’ and ‘encouraging teachers to try out new practices in their classroom teaching’ (see Table 6). Issues of subject knowledge and increased access to resources were less likely to be seen as ‘very successful’ outcomes – despite the prevalence of these issues in the stated aims of many networks and projects.

	Per cent	n
Encouraged teachers to incorporate new ideas into their own teaching preparation and planning	74	43
Allowed teachers to engage with colleagues/peers that they would have not otherwise collaborated with	69	40
Encouraged teachers to try out new practices in their classroom teaching	66	38
Increased teachers’ knowledge of how pupil/student learning of maths can be enabled and supported – i.e. pedagogy	59	34
Increased teachers’ knowledge of how to apply these ideas in practical classroom situations – i.e. teaching practice	55	32
Encouraged teachers to think about/ reflect upon the way that they work as a maths teacher	50	29
Helped teachers to form a network of like-minded colleagues for future support and collaboration	43	25
Increased teachers’ learning in terms of mathematical ideas, knowledge and skills – i.e. subject knowledge	35	19
Increased teachers’ sense of innovation and inspiration in teaching maths	35	20
Encouraged teachers to try out new practices in their assessment of pupil/student learning	30	16
Strengthened teachers’ confidence as maths teachers	28	16
Strengthened teachers’ motivation with regards to teaching maths	25	14
Finding and using other mathematics education resources online	16	9
Provided teachers with a useful source of emotional support	14	8
Finding and using mathematics education resources through the NCETM portal	14	8

Table 6. Perceived areas of success for participating teachers (in response to the question: ‘How helpful do you feel that the network/project was for participating teachers with regards to the following outcomes’). Data are numbers/percent of respondents reporting each factor as being ‘very helpful’.

The networks and projects were also described as having been broadly successful in the interviews, and linked to a range of outcomes and aims. Although most network leads were keen to downplay the benefits of their own roles (*'I don't see any personal gain from doing it you know'* [#7, CX, SW]), some did reflect on the development of their own increased leadership skills, motivation, confidence and sense of self-worth as mathematics educators – *'for me it has really helped me with my job ... improving the quality of teaching and learning mathematics'* [#14, SE, NW]). Other personal benefits for the leads were associated with professional development and growth (especially with leads working within primary education). As these primary leads described:

'I think handling disappointment... it was about being able to translate probably some reasonably negative messages in a positive way...the ability to handle change and disappointment...it made me tougher, a tougher leader' [#1, PR, NW]

'I've gained lots of leadership skills, I've gained organizational and planning skills and have been able to be a part of a wider network of community of math teachers in the north west' [#5, CX, NW]

'It's given me more confidence, it has helped me reposition myself as a certain network leader or someone who has a responsibility to support my local community in developing their practice so, yeah, it has moved me in more profound ways' [#9, SE, SE]

'I've changed as a Head teacher, I've become much more reflective about practice in the school and much less inclined to accept national training because I know that one size does not fit all and that every school needs something different and that you have to develop training that reaches the needs of your staff' [#13, PR, LN]

Perhaps the most significant achievements that were described in the interviews were reflective and interpersonal in nature. As far as many leads were concerned, participating teachers had benefitted immensely from the opportunity to move outside of their day-to-day working lives (albeit on a temporary basis) and reflect on their role as mathematics educators and the nature of mathematics education. These reflective outcomes were seen as being highly significant and often occurring across the groups as well as for individuals. As one lead concluded succinctly, *'it's definitely made us question ourselves'* [#15, CX, NE]. In the words of another lead, the network's main outcome was one of 'opening eyes':

'I think it achieved the aim of opening eyes, I'm not sure it achieved necessarily huge advances in actual pedagogy but there's a lot more awareness out there, a lot more knowledge' [#3, CX, WM]

Not all interviewees shared this teacher's uncertainty over 'actual' changes and advances. In other interviews, this sense of increased self-awareness and expansion of attitude was described in more concrete terms of altered pedagogic practice, changes in pupil motivation and abilities, and a general shift in the 'ethos' of some schools towards mathematics education that in turn involved changes in school and classroom practices and protocols. Various interviewees described, for instance,

'people developing really, really high level professional skills' [#8, SE, NW]; 'people's willingness to embracing a new way of working' [#2, PR, NW]; 'seeing other people's enthusiasm coming through and getting them to try things in the classroom' [#3, CX, WM]; and even an 'increased quality of the pedagogical dialogue' [#12, PR, EM]. As these lengthier quotations illustrate:

'I was surprised at how it welded my staff together doing this type of learning in this particular way, how it helped develop the ethos of the school, it sounds very dramatic but it did ... really thinking together and sharing thoughts and ideas and reflecting together really helped to bind my staff together as a very strong team' [#13, PR, LN]

'It's incredible that over these years the teachers have taken such a journey. They had no belief that anything could improve, anything could change and that ran for the first year or two. But then, very gradually, they began to make some progress and do some innovative things in their schools' [#8, SE, NW]

'The high points for me were children having positive views on the small-group work, teachers noticing things that they might not notice in a whole class and, also, I think it just made maths more important in the school because in many primary schools language and writing has become more important than maths' [#22, PR, EM]

'People actually taking things they were not sure about, trying them in their class and coming back the next time saying that they couldn't believe how much the children were talking about mathematics...and there was a lot of enthusiasm for getting children talking about mathematics ... all of us got quite excited at some point' [#24, SE, SE]

One of the interesting developments in some schools had been the role of the network and project activities in creating and strengthening links between mathematics education and other teachers and subject departments. As one interviewee described, *'our work has definitely inspired other departments'* [#18, SE, SE]. Indeed, a few networks and projects had led to training being 'cascaded' to other non-mathematics teachers in the participating schools – as this lead described, *'a couple of the schools did have follow-up sessions on this teaching method for all the teachers and so ... jointly we have been running training in schools for all the teachers, not just maths teachers. So, yes, it has been cascaded out to other teachers as well'* [#16, CX, E]. In other instances, there was evidence of the networks creating a wider awareness of mathematics as a valuable and accessible topic of study. As this primary school lead teacher described:

'One of the high points now is people's attitudes within the school towards maths. We had a staff meeting last week and we have a half term work on an artist every year. So we were deciding on which artist to do and this one particular teacher who is really not a maths person, she's literacy through and through, she just said in front of everybody in the staff meeting "well, let's do Escher or something because that's mathematical and we can talk about tessellations". I hit the floor, I couldn't believe it. Well, to me even if that was a year after the network had finished that was the best thing, because her passion is in history and literacy. She could have picked a historical painting but she didn't' [#19, PR, EM]

Other leads reported that the network and project activities had impacted noticeably on students:

'The student interviews we did at the time were very, very positive and very powerful in the sense of getting students to think deeply about maths and increase their understanding' [#21, CX, SE].

'Aside from the projects my work with NCETM has had a big impact on the school, we're seen very much as being a strong centre for teaching maths and teaching it well, we don't necessarily get fantastic results because a lot of our students struggle but what we do do is that we make maths accessible to all children at all levels...we have quite creative approaches to maths in this school...we are not pigeonholed in our thinking we're quite progressive in our thinking about how we can deliver...' [#5, CX, NW]

Aside from these outcomes, the longevity of the networks varied across the sample – especially in terms of any continued collaborative activities of participants after the official funding period had elapsed. In some cases, leads and participating teachers had continued their activities through 'spin-off projects' [#9, SE, SE] and efforts to 'continue in some other way' [#6, PR, SW]. While these were often activities and networks of teachers that had pre-dated the NCETM funding, in a couple of instances newly established groups had continued after their funding had stopped:

'A number of the teachers are now going to be involved in a project that it's not a sort of funded project and it's not an NCETM project but we want to be available to provide training for other teachers and supply workshop sessions for other teachers and it means that we've now got a sort of ongoing project, a sort of wider network I suppose' [#16, CX, E]

Often these examples of continued activity were found in projects and networks that were relatively well established, with participating teachers having gained ownership and leadership of the network over time. As one network lead described: 'Over the years the network got a life of its own, it's not my network any more, I still do the arrangements for it and I find a different place to go and I bring tea and coffee and biscuits but I no longer do most of the work' [#11, PS, LN]. However, as the same interviewee was at pains to point out, this apparent spontaneous sustainability was the result of a great deal of previous organisational work and management. As such there was no 'magic solution' to creating a self-sustaining network:

'Don't think that these networks look after themselves, you need to work hard to get a network self-sustaining and it takes time to get it self-sustaining so be prepared to do that if that's what you want to do. If you want to get a network that's self-sustaining it's going to take you a couple of years and it's going to be hard work' [#11, PS, LN]

In contrast, the fixed nature of other networks and projects meant that participants had not expected or intended to have continued any contact or collaboration after the duration of the funded activity. As one network lead reasoned, 'it could have done... but it wasn't a strong network that got to know each other ... it was too short for them to form relationships' [#1, PR, NW]. In this sense, the benefits of some networks and projects were clearly intended to be finite and bounded:

'At the time it was a useful support mechanism but inevitably these projects come to an end and people do not keep in touch because they are too busy. But whilst the project was running - and for a short time afterwards - it has increased their collegiality in that they can say "I was part of that project, my name is on the document" and the document is nationally available' [#21, CX, SE]

Although some leads talked of the need to *'have an official respite'* [#10, CX, E] while harbouring hopes of re-invigorating the networks at a later date, for others this was *'no longer a priority'* [#1, PR, NW]. Yet it is important to stress that, for these interviewees at least, this lack of continued activity was not seen as a sign of failure. On the contrary, the longer-term legacy of the networks in providing an opportunity for teachers to *'think a little bit wider, a little bit more outside of the box'* [#3, CX, WM] was felt to continue in the gradually changing attitudes and actions of teachers that were arising after the cessation of any 'official' network activities. The long-term outcomes of teachers now having *'a broader, wider, more interesting mathematical diet'* [#16, CX, E] were therefore felt to be sustainable without the support of continued network activities *per se*. As one lead of a network focusing on increasing teachers' confidence in using discussion-based techniques in the classroom reasoned, *'I feel there's a slow kind of shift happening but it's still quite soon to say'* [#17, CX, LN]. As the lead of another primary phase project concluded:

'The other thing I would say is that it's still ongoing in spirit, you know. Usually when you do something people get awfully excited about something and they're excited about it while the project runs, but then once the project stops everything closes down, goes back in the cupboard again. I haven't particularly noticed that with this group' [#4, CX, YH]

Looking back, what advice would you offer to aspiring leads of maths teacher networks in the future?

- *'Make sure your timescale is as realistic as possible ... plan for some unexpected elements of surprise' [#2, PR, NW]*
- *'Just go for it, because there's plenty of support and goodwill out there as long as you have the group of committed teachers ... and the time' [#3, CX, WM]*
- *'Do it!... You are going to hit problems every now and again but you'll overcome them anyway ... if you've got a good idea and you think it's worth pursuing, go for it!' [#4, CX, YH]*
- *'Listen to the teachers, let them shape the project, make sure they have plenty of time to gossip during the sessions, make sure you've got a good facilitator' [#8, SE, NW]*
- *'It's hard work, but it's a lot of fun. You get a lot out of it and I'd recommend it to anybody to have a try' [#11, PS, LN]*
- *'Go for it definitely! I think it's transformational, there's been a buzz about the school every day it's been happening' [#12, PR, EM]*
- *'Forward planning and making sure you know exactly what your timeline is and what you're going to do. Make sure that all the dates are put out well in advance so that everybody can plan around those dates' [#14, SE, NW]*
- *'Just make sure you've got a good team... basically that's what makes it work'. [#15, CX, NE]*
- *'Know what you want to achieve, make sure that you're flexible with the other members of staff and be willing to listen to other people's point of view' [#17, CX, LN]*
- *'It's very tempting as a leader and as a trainer to talk, talk, talk ... you have to be prepared to let go and you have to be prepared to say less' [#21, CX, SE]*
- *'Have really clear aims so that you can measure your outcomes against them. Get the support of your management team in school and explain things really carefully. It's really important to explain to them the whole process and how their little part is important in that process' [#22, PR, EM]*
- *'You've got to be able to keep it focused because otherwise if you get members of staff who are very enthusiastic you can lose your focus and they come up with all these brilliant ideas but you can't focus on all of them' [#3, CX, WM]*
- *'Be very clear about what you want to gain from it, keep your objectives clear and straightforward so that everybody know clearly what they are doing and why they are doing it. And be prepared to let teachers enjoy professional dialogue themselves without interfering too much' [#12, PR, EM]*

- *'Make sure you get a supportive set of managers at the school, if your managers don't support you... you might as well pack it in now' [#3, CX, WM]*
- *'Plan meticulously, involve all parties at all the stages of the planning' [#5, CX, NW]*
- *'The commitment of all parties involved is absolutely critical. I also think it's critical that all the parties involved feel they've got some input into actually what's going to happen. Keep everyone on board - people have to feel part of what's going on' [#6, PR, SW]*

2.4. Conclusions and recommendations

- The networks and projects covered in this study were all successful examples of teacher networking and learning communities. The networks and projects were of clear benefit to participating teachers, and were perceived to have led to a range of positive enhancements and changes. Benefits were evident in terms of teachers' individual professional development, classroom practice and the school-wide provision of mathematics education.
- While covering a diverse range of formal topics and activities, many of the main benefits of the NCETM networks and projects were notably 'informal' in nature when compared to the formally stated aims. In particular many groups provided a valuable opportunity for teachers to work outside of the day-to-day routines and restrictions of the school. The projects and networks covered in this study illustrate the benefits of allowing teachers to meet informally, interact with colleagues and peers, and generally have 'space' to reflect on the practice of teaching and on the nature of mathematics as a subject. Participants valued the opportunity to do this – especially when compared to the usual time pressures of teaching.
- While there were some examples of follow-on activities being pursued after the network and projects were completed, most activities ran for a fixed period of time. Given the time pressures faced by many teachers and schools this is perhaps to be expected. Rather than taking the form of continued organised group activities, the longer-term benefits of the networks and projects were mainly being sustained in the form of individual teacher practices and informal collaborations. Any future efforts to fund teacher networks and communities should recognise the value of discrete and finite activities.
- The relatively small amounts of funding provided by NCETM were crucial to the success of the projects. In a practical sense, the funding offered groups the ability to 'buy out' teacher time and cover other small operational costs. However, the funding was important in a symbolic sense - giving projects a heightened status and priority within schools. The kudos of having been awarded external funding was invaluable in allowing projects and networks to run successfully. While many of these groups could have been run using internal school funds, there are clear benefits of an external organisation such as the NCETM providing funding in this way. The NCETM also provided a valuable source of external recognition and validation through the coordination of external conferences, accreditation and award schemes. There would certainly appear to be an added-value of an external and independent organisation underpinning the activities that take place in individual schools and colleges
- The role of the 'leading' and 'co-ordinating' teachers was fundamental to the success of the networks and projects. Many of the projects were clearly dependent on the sustained enthusiasm, goodwill and energy of the lead and co-ordinating teachers. While there is no pressing need for teachers who assume this role to be formally compensated for their work, any attempts to support future projects/networks should consider how lead and co-ordinating teachers may be

supported – especially in terms of developing the organisational and inter-personal skills-sets required to successfully guide groups of teachers.

- A further point for action concerns the apparent need to support maths teachers is thinking and talking further about issues relating to their (lack of) subject knowledge. This is particularly the case in terms of addressing shortfalls in subject-expertise and awareness – issues that may not usually or easily be addressed within conventional CPD provision. It could be desirable, for example, for intentionally informal group activities to be supported that can provide teachers with the opportunity to meet and discuss openly their misunderstandings and gaps in mathematical knowledge.
- A final point for consideration is the role of ICT in supporting the activities associated with the networks and projects. While many teachers were clearly making use of online resources (especially those provided by the NCETM) during their everyday practice, this study found a marked preference for teachers to work together in face-to-face contexts throughout the duration of their networks and projects. While there were some instances of innovative technology use, in general the group-related use of ICT resources was minimal. Any future teacher networking/community programmes should maintain a focus on supporting teachers to meet and work together in face-to-face contexts. Where technology use is encouraged, there may be scope to focus on the 'bottom-up' development of ICT tools and applications within the individual groups alongside the currently centrally provided community functions. For example, informal teacher communication and collaboration may well benefit from groups' adapted use of existing applications such as Facebook, Twitter, Google Groups and Wikimedia alongside 'official' online spaces."

3 – CASE STUDY REPORTS FROM EIGHT NETWORKS AND PROJECTS

Introduction

In addition to the survey and interview data, eight ‘network case study’ visits were made during January and February 2011 to further explore issues emerging from the previous elements of the study. These eight different case studies were selected as illustrative examples of different networks and projects that had been funded by the NCETM from 2006-2011.

	Type of group	Education Phase	Type of project/network	Region
1	Network of schools within a largely rural local authority	SE+PS	MKN	E
2	Network of teachers within one rural primary school	PR	MKN	SW
3	Network of teachers within one 3-19 SEN school	SEN (3-19)	MKN	YH
4	Action research project involving teachers from across two local authorities	SE	TEFP	SE
5	Network of teachers from two secondary schools	SE	MKN	WM
6	Network of teachers within one secondary school	SE+PS	TEFP	NE
7	Network of teachers across one urban local authority	SE+FE	FMKN	LN
8	Action research project involving teachers in primary schools across one urban local authority	PR	TEFP	LN

Phase (PR – *primary*, SE – *secondary*, PS – *post-16*)

Type of project: MKN, FMKN, STEMKN and TAFP

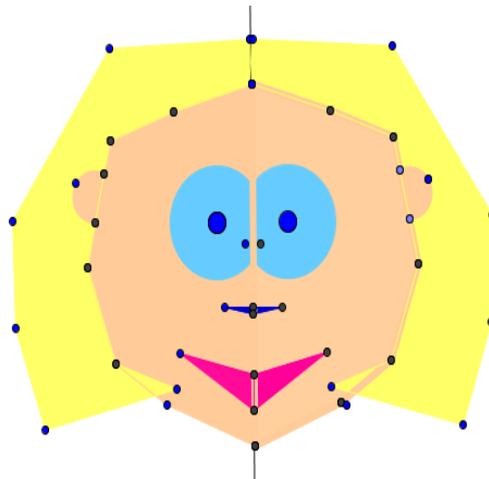
Region (E - *East of England*, EM - *East Midlands*, LN – *London*, NE - *North East*, NW - *North West*, SE - *South East*, SW - *South West*, WM - *West Midlands*, YH - *Yorkshire and the Humber*).

3.1. Case Study one: Using mathematical software in the secondary classroom

How can teachers make effective use of mathematical software in the classroom? What practices and pedagogies are transferable between Key Stage 3 and Key Stage 4? What practices and pedagogies are transferable across different schools? All these questions were explored by an NCETM Network involving eight rural secondary schools in Cambridgeshire – helping teachers to work together to make the best use of ICT in their classrooms

HOW THE NETWORKED ‘WORKED’

A group of twelve teachers working in the eight schools met for monthly ‘twilight’ meetings during the autumn and spring terms of 2009/10. The meetings allowed teachers to get to grips with the use of Dynamic Geometry Software to support the teaching and learning of geometrical concepts.



Initial meetings offered the teachers a ‘hands-on’ introduction to the software. Demonstrations were given by expert users for teachers to learn how to use the software. Teachers were allowed to play with the software themselves, work through examples of lesson material and - most importantly - to learn from each other.

Once the group felt confident, subsequent meetings encouraged teachers to fit the software and lesson plans to ‘their own situation’. After group members had introduced the software into their own classrooms, later meetings gave teachers the chance to exchange experiences, swap tips, and think more broadly about how maths was being learnt through the software.

As the coordinating teacher explained, the NCETM Network provided participants with a valuable ‘starting point’ for their personal use of the software...

‘I provided materials to kick things off, I provided lesson material and training on the use of the software in the first instance and so I provided a sort of starting point but it was very much a case of teachers interpreting this, altering this, making changes to this to fit their own ... to fit the needs of their

pupils in their schools, and to fit the way they believed that maths ought to be taught'

WHAT WERE THE BENEFITS OF THE NETWORK?

- Teachers learnt the technical aspects of using the software in a friendly, supportive and 'low risk' environment.
- Teachers were able to swap tips and advice about using the software with different groups of students.
- Teachers were supported to use different pedagogic techniques.
- Network members were able to cascade their knowledge and enthusiasm about the software to other colleagues in their schools.
- A number of participants then went on to set up an unfunded project to provide 'wider' training workshops for other teachers in the local authority.

WHAT DID THE PARTICIPANTS SAY?

'It was nice to work with people who were doing more than I was AND less than I was ... as well as the actual meetings the real value was the resources that were sent round afterwards ... just the dialogue that happened ... "what do you think about this?" and "how can I improve this?"

[Key Stage 3-4 teacher]

'The session where we shared materials and discovered we were using this software in very, very different ways One of the really exciting things was that teachers took the materials and then turned it into materials they wanted to use'

[Network Lead]

'Within my school we get so little time to sit down and talk about these things ...it's fantastic knowing that there's a meeting coming up and being able to be sat there with similarly minded people ... that doesn't happen very often as well'

[Key Stage 3-4 teacher]

'CONDITIONS FOR SUCCESS'

- The interest and commitment of the participating teachers.
- A common focus (i.e. the software) that all the teachers were interested in.
- A shared expectation that the software would enhance teaching and learning.
- The initial input and the overall coordination provided by the lead.
- Having a range of teachers from different schools made the project more 'helpful and interesting'.
- A developing sense amongst the members that they were gaining ownership of the network.
- The enhanced status of the project within the participating schools derived from the 'highly valuable' NCETM 'umbrella' and funding.

ISSUES AND BARRIERS

The main barriers and problems experienced were related to time – particularly the difficulty of scheduling mutually convenient times to meet across eight schools. It was also easy to underestimate the time needed for teachers to drive from all over the rural county to attend meetings. These logistical issues were overcome by scheduling meetings on a month-by-month basis rather than sticking to a regular fixed timetable.

3.2. Case Study two: Developing creative approaches to using rich mathematical tasks in Years 3 and 4.

How can teachers make use of rich mathematical tasks in Years 3 and 4? How can teachers develop creative approaches to teaching maths and how can students take responsibility for asking their own questions within mathematics? All these questions were explored by an NCETM Network of teachers in a rural primary school in South West England.

HOW THE NETWORKED 'WORKED'

The network was led by an experienced maths teacher working with two teachers and one teaching assistant in the same school. From July 2010 to January 2011 the teachers observed different classroom sessions run by the lead and then met weekly to reflect on what examples of best practice could be transferred into their own classrooms. On occasion the meetings were attended by an external mentor from an independent arts organisation which 'added to the weight and significance' of the Network. Alongside the face-to-face meetings the lead also kept a blog on the NCETM portal – regularly emailing entries to participating teachers.

While the structure of the activities was initially planned by the school senior management team, as time progressed the group developed a more flexible approach – altering their activities in response to how things went during the teaching session. During the initial meetings teachers were presented with a range of possibilities and then given the freedom to select what they felt would work best in their classrooms. Additionally, the collaboration between the group and the independent mentor resulted in the idea of using learning journals with students. As the Network lead explained, these journals proved even more useful than they had originally anticipated...

'We got students to then create collages, they'd sort of cut out the work they'd done on paper and reorganise it in these books and they felt incredibly powerful, the students enjoyed working with them and it really felt like it forced the students in a very helpful way to go back and revisit the work they'd done, to consolidate some of the learning...it's given the staff another tool to aid students' reflection'



WHAT WERE THE BENEFITS OF THE NETWORK?

- Teachers were encouraged to reflect upon their own teaching practices and the teaching practices of colleagues - and then to incorporate new practices into their classrooms.
- Teachers' confidence, motivation and interest in teaching maths increased.
- Introducing the learning journals proved a valuable tool for teachers to incorporate into their day-to-day practice.
- Students' performance was felt to improve as Year 3 and 4 students were able to work on rich and complex tasks within mathematics.
- The Network allowed teachers to link to other schools in the area through the presentation of group work at an annual conference on creativity in education.

WHAT DID THE PARTICIPANTS SAY?

'It was really good and interesting to see the children react to somebody else because you get to see the whole class rather than when you're teaching you get to see exactly what you're focusing on. From the children's point of view they learned so much from the approach, their independence skills and their organisational skills have risen when solving problems so it was a really good opportunity for them'
[Year 3-4 teacher]

'I think it was good to have the opportunity to watch [the lead] work with my class, I think I learned a lot from watching him and watching the children's responses. I think I also learned to stand back a bit more and let them be more independent, let them have more choices and make mistakes for themselves'
[Year 3-4 teacher]

'Since [the lead] came we've been doing stuff like he taught us and it's more fun than what we used to do in class. I just think it's more fun cause all the lessons are "funner", more fun, it's the activities that we do'
[Year 4 pupil]

'We know more ways to solve because if we can't do it one way we can do it another way and get it right'
[Year 3 pupil]

'CONDITIONS FOR SUCCESS'

- The strong commitment of the Head teacher and the support of the rest of the senior leadership team.
- Teachers being enthused by feeling that they were learning during the sessions they observed.
- The built-in flexibility of the network.
- The lead's personal enthusiasm and organisational skills.
- Having a clear timeline and a sense that an external body such as the NCETM were reviewing the project at the beginning.

ISSUES AND BARRIERS

Although the group did not face any real barriers in running the Network they acknowledged the difficulty of securing 'release time' for the teachers to do the observations and then take part in meetings. During the term that the group met this was achieved through the support and interest of the school management team.

3.3. Case Study three: Making maths more concrete for students with Special Education Needs

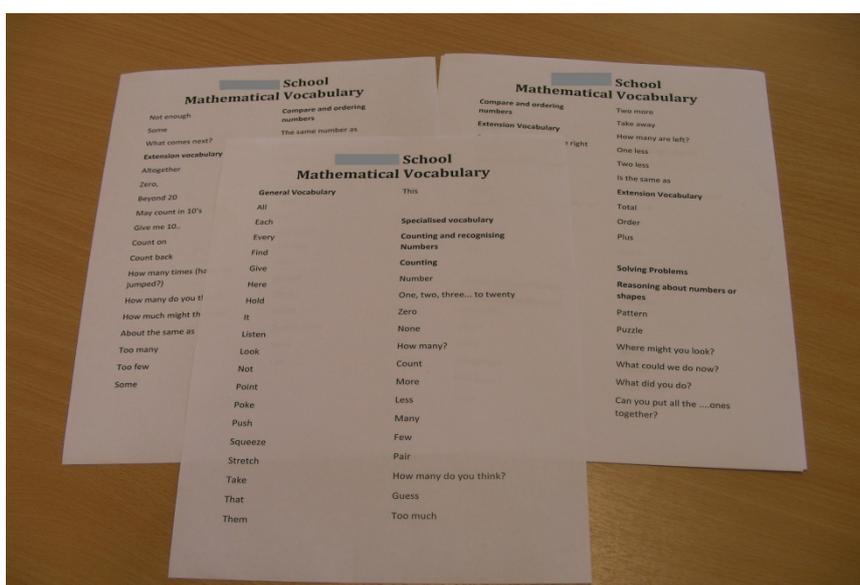
How can teachers develop new ways of supporting students with Severe, Profound and Multiple Learning Difficulties? How can teachers support concrete maths learning experiences for these students? Can students be taught to use mathematics to support them in the development of life skills? What common skills can be used across different year groups and Key Stages? An NCETM Network involving teachers from one SEN school in West Yorkshire explored all these issues.

HOW THE NETWORKED 'WORKED'

Six teachers from the school met on a monthly basis during the autumn and spring terms of 2009/10. After being inspired by information provided on the NCETM website about 'rich mathematical tasks' the Network concentrated on how these could be made more age-appropriate and relevant to pupils with profound and multiple learning difficulties. The group started from a shared belief that mathematical thinking for their pupils would come best through concrete experiences and the use of real objects in the classroom.

An external maths consultant with experience in SEN teaching attended some of the meetings and helped teachers to become confident in delivering rich mathematical experiences. Much of the network activities were centred on developing a range of hands-on resources to use in the classroom – including a group-produced dictionary of 'new mathematical vocabulary' to use across the school. The Network also explored how best to work across different year groups and ensure progression through the school.

The network therefore gave teachers an 'umbrella view' of what was happening across the school with regards to maths teaching and learning. Great care was taken to give participants flexibility to adjust the group activities to their students' needs – therefore giving teachers a sense of ownership over what they were doing.



WHAT WERE THE BENEFITS OF THE NETWORK?

- Teachers explored new ideas and put these in practical classroom situations.
- Teachers began to develop new knowledge about maths for pupils with profound needs.
- Teachers planned and developed exciting and relevant activities – creating a set of bespoke resources tailored to their classes.
- Teachers were able to discuss as a group the difficulties that they were encountering in their own practice.
- Teachers' motivation, interest and confidence in teaching maths was enhanced.
- Teachers were able to understand mathematics education in a whole-school context – developing awareness of the continuity of learning from early years through to post-16 classes.
- Teacher collegiality increased, with participants finding the Network to be a supportive environment in which to share practice.
- Pupils were seen to be motivated by the range of different activities being used in their lessons as a result of the group activities.

WHAT DID THE PARTICIPANTS SAY?

'Because we've had the luxury of being able to meet as a group then we've been able to talk about each other's practice, we've had time to watch each other's practice and that's given us a much better understanding of the progression through the school than we had before. It's given us all a chance to talk'

[Key Stage 3-4 teacher]

'Just meeting and talking fairly informally about what we do was really useful ... the consultant was really really useful in kind of broadening our minds really to slightly different ways of thinking [...] giving us a few different ankles because you get a bit stale, you rely on what you do and what you know you've done in the past and so you need to broaden it out and get other ideas really'

[Early Years Unit teacher]

CONDITIONS FOR SUCCESS

- Individual teacher motivation coupled with a collective sense of involvement as the project progressed.
- Regular senior management support throughout the duration of the project.
- Funding to release teachers for meetings and observations.
- Support and advice gained from group members attending the NCTEM special school conferences.
- Being able to find time to get all the teachers together.

3.4. Case Study four: Planning for ‘cognitive conflict’ in mathematics education

How can maths be made less smooth and predictable for learners – thereby promoting deeper thinking? How can transferable structures be developed to support teachers in planning for ‘cognitive conflict’ in their lessons? These were some of the questions that were explored by a group of teachers and parents that conducted two action research projects on cognitive conflict and mathematics education during 2008-2009 in the South East region.

HOW THE NETWORKED ‘WORKED’

The research group consisted of eight secondary teachers from four schools across two neighbouring local authorities in the South East. These teachers were joined by two consultants from these local authorities. The focus of the first research project was to examine the nature of ‘cognitive conflict’ in maths education. The teachers were especially interested in how cognitive conflict could be provoked in learners to avoid mechanistic thinking. This resulted in the production of a ‘Route to Cognitive Conflict’ toolkit. The second project then built upon this previous work - shifting the focus towards considering ‘the impact of cognitive conflict on learners’ while also producing a companion toolkit.

Both projects combined face-to-face ‘reflective team meetings’ with longer ‘study days’ when group members had more time to discuss and reflect on their activities. Between the meetings there were periods of experimentation during which teachers set up a closed community on the NCETM website in order to share ideas in informal and ‘chatty’ ways and also to store documentation and resources.

The Lead kept the agenda on all of the study days relatively open. This approach was also felt to enhance teachers’ reflection, participation and contribution during the meetings. As the lead described:

‘We shaped the project together because that was more empowering for them than myself imposing it’

WHAT WERE THE BENEFITS OF THE GROUP ACTIVITIES?

- Teachers’ sense of self-esteem and confidence was felt to have increased whilst their pedagogic skills were also improved.
- There was an enhanced sense of collegiality amongst the group participants as their projects progressed.
- ‘The Route to Cognitive Conflict’ toolkit was made ‘publically’ available through the NCETM.
- Teachers were given opportunities for in-depth reflection.
- The project lead was given the opportunity to raise her profile as an LA maths coordinator and to experiment with different ways of delivering CPD.

WHAT DID THE PARTICIPANTS SAY?

'An action research project was a better way of conducting CPD for teachers and the money could be used as an incentive, it gave the whole project a bit more class and a bit more kudos'

[Network Lead]

'I'm surprised with the number of people who have contacted me about this subject area, that they have independently contacted me about it. The level of interest has been surprising'

[Network Lead]

'CONDITIONS FOR SUCCESS'

- Building a shared sense of group identity, and then empowering participants to decide on the direction of the group's work.
- Support from the NCETM regional advisor who set up the online discussion group that helped them to maintain momentum.
- Arranging long 'study days' in nice 'mentally uncluttered' venues away from the workplace.
- The final reports which acted as a final 'pat on the back' for the group members.

ISSUES AND BARRIERS

Both projects experienced similar barriers which were associated mainly with issues of time – in part finding mutually convenient times to arrange the face-to-face meetings, participants finding time to contribute to the reports and a 'long dip' in activity while the first project ran over the summer holiday. These time issues were felt to have been exacerbated by a lack of support from some of the schools' Head teachers who did not always release teachers out of school. Still, the enthusiasm of the participants and the lead was felt to have helped the group overcome these hurdles – sometimes scheduling the meetings at weekends rather than on working days.

3.5. Case Study five: Strengthening mathematical knowledge

How can mathematical knowledge be strengthened to promote the development of functional skills at Key Stage 3 and Key Stage 4, particularly with regard to the new GCSE specifications? How might a focus on problem solving and the application of mathematical skills be best employed to develop and extend mathematical knowledge in a sustainable way? How might a network function between schools and children in the context of the 'Building Learning Power' agenda? These were some of the questions that were explored by an NCETM Network of teachers in a group of schools in the West Midlands when they convened in July 2009.

HOW THE NETWORKED 'WORKED'

At the core of the group was a Mathematics department in a high achieving, selective state school and one of its specialist school partners, a local 11-16 comprehensive school. Also playing a key role were a group of trainee Maths teachers from the local Consortium Graduate Training Programme who had specific support and specific tasks in the network set up by the head of department at the lead school.

Initially registered through the online portal, most of the key successful activity in the network took place in regular face-to-face meetings. These included 'development days' which were seen as crucial in fostering the ethos of the network, namely one of collaborative sharing of best practice, learning together about key aspects of mathematical knowledge which could be supported by problem solving and skill application.

A series of focused planning discussions generated a programme of activity centred initially on producing lesson plans around 'rich tasks'. The work of the network was carefully phased by the members to move towards the goal of helping pupils develop 'meta-cognitive' strategies. The aim was to use pupil-talk and collaboration on task to strengthen the mathematical knowledge. Thus, the pupil development moved in parallel with the development of the network itself between the teachers.

WHAT WERE THE BENEFITS OF THE NETWORK?

- Collaboration between schools was a major success with evidence that this is continuing through planned activities such as pupils from the local comprehensive joining sessions at the lead school.
- Increasing pupil confidence in subject knowledge through developing practical, functional applications and rich tasks collaboratively.
- Providing an opportunity for teachers to meet and develop a specific area of expertise over a longer period of time than was possible through school CPD meetings.
- The presence of GTP trainees in the network allowed all to consider how their strategies work in support of key elements of mathematical knowledge; the

continuing rich conversations about maths among the staff members has been a key benefit in promoting the culture.

WHAT DID THE PARTICIPANTS SAY?

'A key benefit was that it was part of a whole school focus... this notion of Guy Claxton's "Building Learning Power"...allowing pupils to solve things in multiple ways...'

[Network Lead]

'I think if you are looking at promoting this type of thing in the future...the important thing to note is that it isn't the kind of thing that becomes a burden if you've got the support of all of the people involved...'

[Network Lead]

'CONDITIONS FOR SUCCESS'

- Having the support of senior managers is crucial in allocating time and resources to the network.
- Strong and enthusiastic leadership which at the same time ensures that all members in the network feel that they have ownership of the process.
- Having an open-door policy on the sharing of classroom strategies alongside fostering the culture of mutual support for good ideas in teaching generally and the development of meta-cognition specifically.
- Incorporating trainee students in the process has been one element behind the success of the network, harnessing enthusiasm and willingness to learn.

ISSUES AND BARRIERS

Teachers, understandably, can become defensive about changing their practice through peer observation and dialogue because they work in a performative culture, regularly observed by managers or by OFSTED. Developing teacher reflection on what normally happens in classrooms required sensitive, facilitative dialogue based on asking people to think about what they do in a habitual way in their day-to-day teaching. This happened over time through encouragement, discussion and sensitive classroom observation and dissemination through a supportive, well-led network.

3.6. Case Study six: Using handheld technologies to support interactive mathematics learning

How can wireless handheld calculators be used to support assessment within the mathematics classroom? Is it possible for maths teachers to change their teaching practices and adapt to using these new tools? How compatible are these technologies with existing school practices? How do the learners feel about using wireless calculators? These were some of the questions that were explored by an NCETM Network of teachers in one comprehensive school in the North East region between April 2010 and January 2011.

HOW THE NETWORKED 'WORKED'

The group consisted of three secondary teachers from the same school and a PGCE tutor from a local university. The group focused on using wireless handheld technologies in Year 7-10 maths classes. The PCGE tutor attended meetings, helped with planning the project and writing the proposal, and also provided feedback to the participants throughout the course of the group activities.

During the group's monthly meetings participants planned lessons that made use of the technology, while also being trained by the lead on how to use the wireless handheld calculators. The sessions were also aimed to give teachers targets that were achievable in the four weeks or so between meetings. As the group progressed, all teachers became involved in the development of activities and the setting of their own targets.

Besides the more formal monthly meetings, teachers also used the technologies in their teaching most weeks, and throughout the project they took time to observe each other and also be observed by the lead. This gave participants the opportunity to provide *and* receive feedback on the classroom use of the wireless calculators.

WHAT WERE THE BENEFITS OF THE NETWORK?

- Providing an opportunity for teachers to meet and develop a specific area of expertise over a longer period of time than was possible through school CPD meetings.
- Increasing teacher confidence and motivation in using an unfamiliar technology in the classroom.
- Allowing teachers to experience different methods and styles of teaching by being given time to observe other teachers.
- Having the network provided teachers with an informal and collegial source of technical support – with staff learning from each other.
- Implementing the wireless handheld technologies in the classroom was felt to increase pupils' interest in maths - the calculators were seen by teachers as acting as an incentive that enhanced student engagement and motivation.

WHAT DID THE PARTICIPANTS SAY?

'For me it was sharing practices and watching each other use ideas and I think that's the most useful thing, planning together and then watching each other teach using the network...it has also made me try new things that I probably wouldn't have before, that's

probably come from just having the time to collaboratively plan and get ideas from each other'

[Key Stage 3 teacher 1]

'I think it's always good when you are trying something new if you have somebody to fall back on who is going through the same sort of issues you might be whereas I think if it had just been J. Maybe I'd have felt a bit stupid going to him and saying "I don't know how this works again" whereas I don't really care with x and y because I know they're probably struggling just as much as I am'

[Key Stage 3 teacher 2]

'The project has given us time to observe each other, time to plan lessons, to sit down as a three and talk about it whereas normally we wouldn't get that luxury'

[Key Stage 3 teacher 3]

'I think they are dead fun and useful with the games that you can play on them, it was a very different way of learning about maths cause instead of just sitting there doing the sums you are using technology to find the answer'

[Year 8 pupil]

'CONDITIONS FOR SUCCESS'

- Making sure that participants were keen and willing to get involved and happy to take ownership of the project.
- Having senior leaders 'on side' as this allowed teachers to take time off to meet, and to plan subsequent activities.
- Having the financial backing of the NCETM to allow participants to have time out of lessons to work on the project.

ISSUES AND BARRIERS

The main problems encountered by the group were technical – with the wireless technologies initially conflicting with the school's network. These problems were overcome with the help of the school's ICT department.

3.7. Case Study seven: Developing mathematics education at Key Stage 5

How can teachers across a local authority share their expertise and mathematical knowledge? How can teaching and learning be enhanced in maths and further maths? How can subject knowledge and pedagogies be improved? These have been some of the questions explored by an ongoing NCETM Network of teachers across East London that started in spring 2008.

HOW THE NETWORKED 'WORKED'

The network was started by a Further Maths coordinator based in London – initially inviting twelve teachers from schools across East London take part. Some of the original teachers have since moved on and been replaced by others. However a core group of six teachers have remained since the beginning. While the focus of the network has continued to be on 'developing teaching and learning at Key Stage 5', the group has been organised around an open agenda. Topics are set by the teachers themselves, with meetings having a different focus depending on the teachers' needs at the time.

The group meets six times a year. Between meetings teachers often exchange individual emails with the lead as well as group emails if they need help or advice. As the lead described:

'There is quite a lot of cross-chat between the schools so one person will remember talking to another person about something so they'll email them and follow it up and they might go and visit them and these are more informal contacts '

WHAT WERE THE BENEFITS OF THE GROUP ACTIVITIES?

- Teachers have improved their teaching practices and subject knowledge.
- Enhanced sense of collegiality amongst the group participants - teachers feel they are not alone and can share concerns and pressures.
- Enhanced access to useful resources and guidance, helped teachers reduce workload
- Opportunities for teachers to share practices with colleagues on a more informal basis.

WHAT DID THE PARTICIPANTS SAY?

'I think it's the willingness of the teachers to want to develop their own practice, they keep coming, they turn up on wet winter nights when they might be tired at the end of their teaching and they still come. They feel that they get much more, right from the very beginning I tried to ensure that leaving a meeting you felt that it was worth driving there, spending time there and getting home late. And you came out thinking "well, I'm late home but look at all those great resources or ideas I've got or a bit of inspiration from somebody else". That's what keeps them coming'

[Network Lead]

'What we got from our Network first of all is improved practice in teaching and learning at

Key Stage 5, there's definitely been a progression as to how we work and teachers feel a lot more confident about taking risks, trying out new things, sharing with one another'
[Network Lead]

'CONDITIONS FOR SUCCESS'

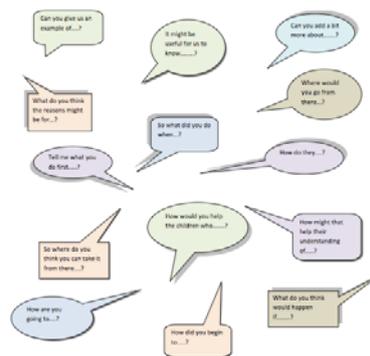
- Having the support of local maths consultants and advisors across the authority - publicising the network to local maths teachers.
- The local authority allowing the group to use the meeting facilities of the professional centre.
- The motivation of the network lead in terms of organising meetings and maintaining enthusiasm.
- Transferring ownership of the network over time to the participating teachers so that they feel they are part of something meaningful and worthwhile.
- The willingness and commitment of the teachers to keep engaged and staying eager to develop their own practice.

ISSUES AND BARRIERS

This has been a particularly successful and sustainable network and so far they have not experienced any issues and barriers. However, the group are facing the prospect of losing their free premises for the face-to-face meetings due to impending local authority cuts. As a result meetings will either be run at different schools (involving more travelling time for participants) or else the network will split into two different groups based on geographical location.

3.8. Case Study eight: Using ‘activity learning’ to develop teachers’ mathematical dialogue

How can math teachers be supported to identify and explore problems themselves through the use of dialogic techniques? Can theories of ‘activity learning’ help in developing primary teachers’ pedagogical skills and subject knowledge? These were some of the questions explored by an NCETM Network that has been running as an action research project since June 2008. Teachers have been drawn from a number of primary schools across one London Authority.



HOW THE NETWORKED ‘WORKED’

The project was triggered by the Lead teacher’s PhD research project, which focused on different ways of improving mathematical performance. Since starting in 2008 the network has been organised around three different sets of activities. The first group ran from July 2008 to July 2009. This involved head teachers, maths coordinators and other senior managers from five primary schools. This group held six meetings with the aim of developing a model of applying ‘activity learning’ techniques in the maths classroom. The focus here was exploring how to use activity learning procedures to support teacher dialogue and reflection.

During the following year separate groups of classroom teachers from two of these schools implemented open-ended questioning techniques in their own classrooms. This work was then continued with two other schools – introducing more teachers to activity learning techniques. In total the project has involved about sixty teachers in a variety of school-based clusters.

The overall focus of the project has been to encourage teachers to collectively reflect on their own practices *and* their subject knowledge. The groups have allowed teachers to regularly re-evaluate their practice. At all times, the agenda has been kept intentionally open – allowing groups to respond to the issues that have arisen in the course of the daily teaching. The second group developed an especially successful technique of allowing a succession of different teachers to present a personally-selected mathematical issue to their colleagues. Through open-ended questioning the group has tried to improve their collective ability to reflect on their practices and then take a more dialogical approach into their individual classrooms.

WHAT WERE THE BENEFITS OF THE NETWORK?

- Teachers working and thinking collaboratively to share ideas and practices.
- Helping staff form 'communities of practice' within and across schools in one local authority.
- Teachers gaining a better understanding of what happens in maths across year groups.
- Giving the teachers time and space for in-depth reflection.
- Developing teachers' appreciation of the importance of dialogue within their own classrooms.
- Staff feeling more valued by colleagues.
- Improved mathematical achievements by students.

WHAT DID THE SCHOOLS SAY?

'It's all about collaboration because you have to really listen...to what the Set members are saying so that you can build on their questions and learn to dig deep and probe someone's thinking. And in that way teachers' mathematical beliefs come to be challenged and they sometimes change the way they think and it certainly can change the way they set about teaching a new concept'

[Network Lead]

'It helps with your confidence with your colleagues because if you've got any problems you can still go to your colleagues and ask them "I tried this, what can I do to make it better?" so now I think I feel a bit more free to go to my colleagues and ask them for ideas or share ideas'

[Year 2 teacher]

'It's helped me unpick the problem, to see where I needed to start from and where to build up...it's helped me get the children recognise the connections rather than on a separate day we're doing this and another day we are doing that, it helped them interlink what we are doing'

[Year 4 teacher]

'CONDITIONS FOR SUCCESS'

- The support of motivated and interested head teachers and senior managers.
- Teachers' commitment and engagement with the group, coupled with their ongoing enthusiasm and willingness to stay after school for the meetings.
- The NCETM funding helping to cover travelling expenses and release the lead and teachers from their duties.
- Having a very strong purpose behind the project such as their own need to improve their school's performance.
- Having a dynamic and motivated lead to drive the project.
- Being prodded by the NCETM to 'get on with it'.

ISSUES AND BARRIERS

Making time for the meetings and also having time to visit the other schools was identified as the most important barrier. However, this was overcome through the teachers' willingness to arrange meetings after school, and through the use of NCETM funding to release teacher time.

APPENDIX ONE

Background material and further reading

- DfE (DfES as was) has produced a range of teacher-guides and resources relating to professional learning communities:

Stoll, L., Bolam, R., McMahon, A., Thomas, S., Wallace, M., Greenwood, A. and Hawkey, K. (2006) *'Professional Learning Communities: source materials for school leaders and other leaders of professional learning'* Innovation Unit, DfES, National College for School Leadership and GTC, Nottingham

- NfER has produced a comprehensive review of existing theoretical and conceptual literature:

Kerr, D., Aiston, S., White, K., Holland, M. and Grayson, H. (2003) *'Review of networked learning communities: literature review'* Slough, National Foundation for Educational Research

- There is also a range of academic literature and studies of teacher networks, including:

Dresner, M. and Worley, E. (2006) 'Teacher Research Experiences, Partnerships With Scientists, and Teacher Networks Sustaining Factors From Professional Development' *Journal of Science Teacher Education*, 17, 1, pp.1-14

Firestone, W. and Pennell, J. (1997) 'Designing State-Sponsored Teacher Networks: A Comparison of Two Cases' *American Educational Research Journal* 34, 2, pp. 237-266

Lieberman, A. (2000) 'Networks as Learning Communities' *Journal of Teacher Education* 51, 3, pp.221-227

Muijs, D., Ainsow, M. and Chapman, C. (2011) *'Collaboration and Networking in Education'* Rotterdam, Springer

Niesz, T. (2007) 'Why teacher networks (can) work' *Phi Delta Kappa*, pp.605-610

Pennell, J. and Firestone, W. (1996) 'Changing Classroom Practices through Teacher Networks: Matching Program Features with Teacher Characteristics and Circumstances' *Teachers College Record*, 98, 1 pp.46-76

Selwyn, N. (2000) 'Creating a 'Connected' Community? Teachers' Use of an Electronic Discussion Group' *Teachers College Record* 102, 4, pp. 750-778

APPENDIX TWO

Further information on research methods

The research questions were addressed through three phases of linked research activity. These phases of research activity were designed to provide a comprehensive and rigorous approach that was also achievable within the limited timescale of the research project:

1. Online survey of all NCETM network leads [late December 2010 until January 2011]

An online survey was developed and hosted for all the 160 named leads and coordinators of the 185 funded NCETM networks – i.e. MKN, FMKN, STEMKN and TEF activities. Invitations to complete this survey were personally sent to all Network leads and coordinators, resulting in a comprehensive coverage of Network leads across the various NCETM Networks. Network leads were invited to complete surveys at the end of December 2010, with a follow-up reminder sent three weeks after. This survey was designed to take no more than 20 minutes to complete, and to collect information about the nature and form of the Network lead's role in the development and support of the Network; their personal and professional backgrounds; and engagement in other forms of professional development and networking. A dedicated section was designed to assess the design of the Network – for example, in terms of its focus on certain aspects of mathematics knowledge, teaching methods, or other aspects of mathematics education; the range of activities that were planned and intended; the intended nature of teacher exchange and opportunities for leadership within the network). A further section was designed to explore issues surrounding the factors underpinning the eventual sustainability of the network; as well as the perceived outcomes of the network (both for the Network lead and the participating teachers). In a final section of the survey, Network leads were invited to volunteer for follow-up telephone interviews.

Completed surveys were gathered from 73 Network/Project leads and coordinators – a response rate of 45.6 percent. As can be seen in table 7, the sample was relatively representative of the wider teacher population in UK schools. Three-fifths of the sample was female, with the majority aged 40 years or over. Respondents' experience of working in education ranged from 4 to 40 years - with an average of 16.62 years (s.d.=9.57). Nearly 90 percent (n=63) classed themselves as maths specialists, three-quarters having studied mathematics at university degree level or above (n=53). For three-fifths of the sample (n=42), this was their first involvement with a similar teacher network or learning community activity.

In terms of the nature of the respondents' networks and projects, most had been operational during the past two calendar years and two-thirds involved teachers from more than one school/college. The number of teachers involved in the network/project ranged from 2 to 90, with a mean number of 12.9 teachers (s.d.=14.52). The duration of the networks/ projects ranged from 3 months to 72 months, with an average of 15.2 months (s.d.=13.8). The majority of projects met 10 times or less during their lifetime.

	Per cent	n
Gender		

Male	37	26
Female	63	44
Age of Network/project Lead		
24 years or less	0	0
25-29 years	4	3
30-39 years	36	26
40-49 years	28	20
50-59 years	28	20
60 years or more	4	3
Phases of education covered by the Network/project		
Key Stage 1	22	16
Key Stage 2	29	21
Key Stage 3	45	33
Key Stage 4	32	23
Key Stage 5	34	25
Other Post 16	3	2
Higher education	3	2
Composition of participating teachers		
Teachers all from the same school/ college	32	22
Teachers from different schools/ colleges	68	46
Years when networks/projects were active		
2006	1	1
2007	7	10
2008	20	27
2009	38	52
2010	51	70
2011	27	37
How many times network/project activities took place		
0 to 5 times	26	17
6 to 10 times	47	31
11 to 19 times	14	9
20 times or more	14	9

Table 7. Survey respondent characteristics

(n.b. summed totals may not add up to 73 due to missing responses to particular items; summed percentages may not add up to 100 due to rounding up/down).

2. Follow-up telephone interviews with a representative sample of NCETM network leads [January to February 2011]

From the middle of January 2011 onward, in-depth semi-structured telephone interviews were held with a representative range of Network leads and coordinators who completed surveys and agreed to be interviewed in more depth about their Network. As well as following-up on points raised in the surveys, these telephone interviews were used to concentrate on issues relating to the factors that can be associated with the sustainability and success of the networks, as well as issues relating to how similar networks can be established and sustained in the future. As can be seen in table 8, telephone interviews were conducted with 25 Network leads and coordinators - focusing on an indicative range of Networks and associated projects in terms of Mathematics Topic; Teaching & Learning Context; Education Sector and Stage.

	n
Gender	
Male	9
Female	16
Phases of education covered by the Network/project	
Primary	9
Secondary	6
Post-16/HE	2
Cross Phase	8
Region	
East of England	2
East Midlands	3
London	3
North East	1
North West	5
South East	5
South West	3
West Midlands	1
Yorkshire and Humber	2

Table 8. Interviewee characteristics

3. Case-study visits to eight NCETM networks [February 2011]

Finally, eight ‘network case study’ visits were made to provide an invaluable opportunity to further explore issues emerging from the previous elements of the study. Based on the results of the previous stages of the project, eight indicative teacher networks were selected for further study – again focusing on an indicative range of Networks and associated projects in terms of Mathematics Topic; Teaching & Learning Context; Education Sector and Stage. In the first instance, the Network leads were visited and interviewed in their schools/centres. Where possible (i.e. where Networks are based in individual schools and/or local clusters of schools) other Network participants were also interviewed. Where Networks were based within individual schools, the opportunity was taken to interview a range of students about their experiences of classroom activities resulting from their teachers’ Network-supported development. Supporting documentary material relating to the individual Network was also collected, and short videos were made of Network leads offering brief ‘How To’ testimonials and guidance for future Network leads (this material has been used for the production of practitioner content for the NCETM portal). The reports of the eight case-study networks and projects are included towards the end of the main report.

4. Analysis of data

While representing nearly half of the network leads, the comparatively small and non-probability nature of the online survey sample merited a relatively basic set of analyses. Given the simple questions of patterning which we wished to derive from the data, analysis

of these survey data has been described in terms of frequencies and cross-tabulations. In terms of analyzing the data arising from the in-depth interviews with network leads the 'constant comparison' technique was used. This first involved reading all the interview transcripts to gain an overall sense of the data. A sample of the data set was then read again and 'open-coded' until, in the opinion of the researchers, analysis had reached theoretical saturation. From this basis the whole data-set were then coded selectively in terms of categories identified with the initial code list directly related to the aims of the study. Thematic analysis enabled the data from the different data sets to be combined to produce a coherent variety of influences and factors underlying the implementation of the networks and projects.

APPENDIX THREE

Sample research instruments

1. Online questionnaire for network/project leads

NCETM Network Assessment NETWORK LEAD QUESTIONNAIRE

BACKGROUND TO THE SURVEY

As someone who has been the named lead of a network/project funded by the National Centre for Excellence in the Teaching of Mathematics (NCETM) we would be very grateful if you could complete this short questionnaire.

Your responses will be used to assess the impact of the NCETM network programme and make recommendations about future work in this area.

The survey should take no more than 20 minutes to complete, and has been designed to collect information about your experiences and views of the network/project activities. There are four different sections (labelled 'A' through to 'D').

This is an independent assessment conducted by a research team from the Institute of Education - University of London. Your responses will be kept confidential – even to the NCETM team - and will not be used for any other purpose than the current assessment project.

Please feel free to skip any questions that you are unsure of or feel are not applicable (especially if your network/project is still ongoing).

If you have any questions about the survey then please contact Neil Selwyn at the Institute of Education – n.selwyn@ioe.ac.uk

A. Your professional background

Including the current year, how many years have you worked in education? (*Exclude extended periods of absence such as career breaks, also exclude your initial teacher training*) _____ (years)

Would you class yourself as a maths specialist?

Yes No

What is your highest level of education? (*Choose one.*)

Bachelor's degree (BSc, BA or equivalent)

Master's degree (MSc, MA or equivalent)

- Doctoral degree (PhD, DPhil, Ed.D or equivalent)
- Other

What is your highest level of mathematics-related education? (*Choose one – this may be same as before*)

- GCSE, O-level (or equivalent)
- A-level (or equivalent)
- Foundation degree (or equivalent)
- Bachelor's degree (BSc, BA or equivalent)
- Master's degree (MSc, MA or equivalent)
- Doctoral degree (PhD, DPhil, Ed.D or equivalent)

Had you been involved in similar teacher networks or 'learning community' activities before the NCETM-supported network/project started?

- Yes
- No

What is your age? (*Choose one.*)

- Under 25 years
- 25-29 years
- 30-39 years
- 40-49 years
- 50-59 years
- 60 years+

Are you ...

- Male
- Female

B. Details of the network/project that you lead

What phases(s) of education was the network/project focussed on?

- Key Stage 1
- Key Stage 2
- Key Stage 3
- Key Stage 4
- Key Stage 5 or equivalent
- Other post-16 education
- Higher education (e.g. foundation degree, undergraduate)

What was the main focus of the maths network/project that you led/facilitated? *Please list as many areas as you want.*

Where did the initial impetus come from to initiate the network/project? (*Tick all that apply.*)

- I was personally interested/motivated to get involved

- I was working on behalf of a group of colleagues/peers who had collectively decided to work together
- I was invited to do so by a senior colleague/manager within my school or college

Why did you decide to initiate the network/project? (Tick all that apply.)

- I/we wanted to get involved in a professional community
- I/we wanted to develop mathematics capacity within our own institution
- I/we wanted to win an external grant/funding
- I/we wanted to do action research
- I wanted to develop experience of leading a project
- Other _____

What did you personally hope to gain from being involved in the network/project? Please list as many areas as you want.

How many teachers were involved in the network/project activities? (approx.) _____

Were all these teachers ...

- All from the same school/college
- From different schools/colleges

What topics and activities was the network/project aiming to address? (Tick all that apply.)

- Supporting teachers to talk about mathematical knowledge and skills – i.e. subject knowledge
- Supporting teachers to talk about how pupil/student learning of maths can be enabled and supported – i.e. pedagogy
- Supporting teachers to talk about how to apply these ideas in practical classroom situations – i.e. classroom practice
- Supporting teachers to talk about topics not related to mathematics education
- Helping teachers to share/recommend existing teaching resources
- Helping teachers to develop new schemes of work
- Helping teachers to create/produce new teaching resources
- Helping teachers to research their own classroom practice
- Other (*please describe*) _____

How did the network/project operate? (Tick all that apply.)

- A series of scheduled meetings/ sessions
- The production of teaching/learning resources
- The production of a publication/ report
- The planning and carrying out of a research project/ enquiry
- Email discussions
- Discussions through NCETM forums/ communities
- Discussions through other online forums/ communities
- Informal exchanges and conversations (face-to-face)
- Other (*please describe*) _____

During which years did these activities take place?

2006 2007 2008 2009 2010 2011

How long were you personally involved in these activities?

_____ (months)

During this period, how many times did network/project activities take place?

0-5 6-10 11-19 20+

Which of the following best describes the organisation of the network/project?

- 'Top-Down' – i.e. formally organised, clear goals and aims, clear management and structure
- 'Bottom-Up' – i.e. less formally organised, 'organic' goals and aims that were evolving in nature
- A combination of both

Were there any particular helps or hindrances that you faced in setting-up and establishing the network/project? *Please list as many issues as you want.*

C. What teachers gained from the network/project

How helpful do you feel that the network/project was for participating teachers with regards to the following outcomes?

	Very helpful	Fairly helpful	Not very helpful	No help at all	Not sure/ not applicable
Increased teachers' learning in terms of mathematical ideas, knowledge and skills – i.e. subject knowledge					
Increased teachers' knowledge of how to apply these ideas in practical classroom situations – i.e. teaching practice					
Increased teachers' knowledge of how pupil/student learning of maths can be enabled and supported – i.e. pedagogy					
Encouraged teachers to incorporate new ideas into their own teaching preparation and planning					
Encouraged teachers to try out new practices in their classroom teaching					
Encouraged teachers to try out new practices in their assessment of pupil/student learning					
Encouraged teachers to think about/ reflect upon the way that they work as a maths teacher					
Allowed teachers to engage with colleagues/peers that they would have not otherwise collaborated with					
Helped teachers to form a network of like-minded colleagues for future support and collaboration					
Provided teachers with a useful source of emotional support					
Strengthened teachers' motivation with regards to teaching maths					
Increased teachers' sense of innovation and inspiration in teaching maths					
Strengthened teachers' confidence as maths teachers					
Finding and using mathematics education resources through the NCETM portal					
Finding and using other mathematics education resources online					

D. How the network 'worked'

Looking back, how useful did you feel that the network/project was to the majority of teachers who participated?

- Very useful
- Fairly useful
- Of little use
- No use at all

Looking back, how useful do you now feel that the network/project was to you personally?

- Very useful

- Fairly useful
- Of little use
- No use at all

Looking back, how successful did you feel that the network/project was in achieving your original aims?

- Very successful
- Fairly successful
- Not very successful
- Not successful at all

How important were the following issues relating to the nature of the network/project?

	Very important	Fairly important	Not very important
The interest and/or commitment of other members of the network/project			
My own personal commitment to facilitating and leading the network/project			
My own personal organisational skills in facilitating and leading the network/project			
My own personal enthusiasm in facilitating and leading the network/project			
My own personal leadership skills in facilitating/leading the network/project			
Support and advice from the central NCETM office/ team			
The financial support of the NCETM award			
Having support and commitment from senior leaders/ managers in my own institution			
Having a clear focus on certain subject areas, teaching methods, or approaches to enhancing professional development			
Having a variety of activities that gave teachers flexibility in what they covered			
Teachers having the opportunity to share leadership of the network/project, and decide on the nature of the activities			

How important were the following teacher-related issues?

	Very important	Fairly important	Not very important
Teachers having enough time during the school/college day to participate in the network/project activities			
Teachers having enough time outside of school/college to participate in the network/project activities			
Teachers feeling interested in the activities/topics			
Teachers feeling motivated to engage in the activities/topics			
Teachers feeling that the activities and topics were relevant			

to their own teaching			
Teachers feeling that the activities and topics matched their own beliefs about teaching			
Teachers having the freedom to alter the nature of the network/project to fit the group's interests and needs			
Teachers 'getting on with' the other participants in the network/project			

Were there any particular helps or hindrances that you faced in sustaining the network/project, and keeping it going? *Please list as many issues as you want*

Has the network/ group worked together since the end of the 'official' funded activities?

Yes No

If you have continued with the network/project after the end of the 'official' funded activities, what has been the focus/topic of subsequent activities?

Were there any unexpected or surprising outcomes that came from the network/project?

Please list as many issues as you want

Would you lead/ facilitate a similar network/project in the future?

Yes No Maybe

FINALLY - we would be very interested in expanding on these issues through a brief telephone interview with a small section of network/project leads. If you are able to volunteer to take part in a follow-up telephone interview during the next few weeks then please leave your email address.

Yes – I would be happy to take part in a subsequent telephone interview. Please use this email address: _____

THANK-YOU FOR YOUR HELP!

2. Telephone interview schedule for network/project leads

NETWORK LEAD – Telephone interview schedule

Background to the interview

As someone who has been the named lead of a network/project funded by the National Centre for Excellence in the Teaching of Mathematics (NCETM) we are very grateful that you can take the time to be interviewed.

Your responses will be used to assess the impact of the NCETM network programme and make recommendations about future work in this area.

This is an independent assessment conducted by a research team from the Institute of Education - University of London. Your interview data will be kept confidential – even to the NCETM team - and will not be used for any other purpose than the current assessment project.

The interview should take no more than 45 minutes. In order to make sure that we catch everything that you say, can I first check that it is all right to record the interview? PAUSE TO GAIN CONSENT

How did it all start?

How did you first get involved in the Network / what was the early history?

Probe for:

Initial motivation, initial intentions, initial plans?

Spurred/initiated by the offer of NCETM funding?

Was this a first ... or the kind of thing that you/the group had done before?

Probe for: Group decision or individual decision, how did you become the named lead?

Was this a pre-existing group/ network?

- Can you outline what the Network/ project intended to do?
- Were there specific set aims/ goals/ outcomes?
- Were there specific set activities and plans from the start?
- What did you personally hope to gain from being involved in the Network?

How easy was it getting things going/ getting things off the ground?

Were there any particular helps/hindrances that you faced in setting-up the Network ... and getting it going?

Probe: head-teachers, resources, time, motivation, interest/apathy?

Looking back, what advice would you give something starting-out on a similar venture now?

Running the network

How did the Network operate?

How was the network run? Top-down, centrally managed and organised ... or more 'organic' and taking form as time passed?

What were the high points?

What were the low points?

How did you/ the group keep the network running? Any lapses/ dips? Did activities and efforts coincide with school calendar/school year (especially re. maintaining momentum over assessment periods, holidays)

Outcomes and benefits

OUTCOMES FOR THE GROUP/COMMUNITY

How useful did you feel that the network was to the majority of teachers who participated?

How successful did you feel that the network was in achieving your original aims?

To what extent do you feel that the Network/ project led to the following outcomes?

- *Mathematical knowledge and skills – i.e. subject knowledge*
- *Knowledge of how students' learning of maths can be enabled and supported – i.e. pedagogy*
- *Knowledge of how to put these ideas into action in practical classroom situations – i.e. teaching practice*
- *Actively trying out new practices in their classroom teaching*
- *Incorporating new ideas into teaching preparation and planning*
- *Actively trying out new practices in assessment of students' learning*
- *Encouraging teachers to think about/ reflect upon the way that they work as maths teachers*
- *Encouraging teachers to change the way that they work as maths teachers*
- *Providing teachers with a useful support mechanism*
- *Increasing teachers' sense of collegiality with other like-minded peers*
- *Strengthening teachers' motivation*
- *Strengthening teachers' interest in teaching maths*
- *Strengthening teachers' confidence*
- *Changes to teachers' view of their own need for professional development and of the value of it generally*
- *Increased knowledge of whereabouts of useful resources and guidance*

Are you able to provide any specific/ concrete examples of the benefits of teachers' engagement in the Networks being translated into classroom practice and – it follows –

outcomes/ benefits for learning [Probe – increased understanding, motivation ... what was it that learners gained?]

OUTCOMES FOR YOU AS AN INDIVIDUAL

- What has been 'in it' for you from leading and running the Network? What have you gained? How has your teaching/professional growth been impacted? Probe: as a teacher, as a colleague, as a leader
- How have you grown personally this year as a maths teacher as a participant in this project?
- In what ways (if any) has your definition or concept of maths teaching changed?
- How has your department and/or school grown programmatically or otherwise this year as a result of this project?

[END QUESTION FOR THIS SEGMENT]

Were there any unexpected or surprising outcomes that came from the Network/ project?

Sustainability/ post-project outcomes

Are you in touch with the network participants in any way? Is the Network continuing on an unofficial basis? Explain?

Was there any legacy of the work when the network officially finished? - did the group continue in same or different forms? Did the initial project trigger new ways of collaborating/ working?

IF SO - what goals might you have for next year as a group?

IF NOT – why do you think that nothing more has happened?

Looking back – what is the key to success?

DRIVERS (OF SUCCESS)

In your experience, what would you say are the factors that support an effective network - i.e. effective in the sense of:

1. getting going and doing something
2. achieving some outcomes that match in some way the objectives or if not track how things change and why
3. being able to identify and talk about the key factors in project and outcomes
4. some sort of sustainability [ask specific question on sustainability/ 'keeping things going']

Prompts/probes

- *The interest and/or commitment of other members of the Network*
- *Your own personal commitment*
- *Your own personal organisational skills*
- *Your own personal enthusiasm*
- *Your own personal leadership skills*
- *Support from the central NCETM office/ team*

- *The financial support of the NCETM grant*
- *Having support and commitment from senior leaders/managers*
- *Having open and transparent communication between network members*
- *Having a clear focus on certain subject areas, teaching methods, or approaches to enhancing professional development*
- *Having a variety of activities that give teachers flexibility in what they covered*
- *Teachers having the opportunity to lead/ decide on the nature of activities*
- *Teachers being able to talk though issues with other members of the Network rather than by being talked at by experts*

BARRIERS (TO SUCCESS)

In your experience, what would you say are the factors that stop/ hinder an effective network - i.e. effective in the sense of:

1. getting going and doing something:
2. achieving some outcomes that match in some way the objectives or if not track how things change and why:
3. being able to identify and talk about the key factors in project and outcomes
4. some sort of sustainability

Prompts/probes

AS ABOVE ... plus:

- *Teacher time*
- *School pressures – curriculum/ assessment/ management etc.*
- *Teacher interest, motivation*
- *Teachers feeling that the activities/topics matched their own beliefs about teaching*
- *Inter-personal issues – e.g. teachers liking the other members of the Network*

Finally Just out of interest as a non-maths person I was wondering whether there is anything about maths as a subject that specifically benefits from teacher networking/ learning communities?

Is there something about maths as a subject that needs these kinds of networks?

Perhaps

- Maths as an intellectually tough subject area?
- The nature of subject (the language and hard to identify what is important?)
- Maths Teachers (or maths specialists) feeling especially isolated within a school [especially re. Primary]?
- The fact that maths is shortage subject ... teachers not feeling comfortable etc
- The fact that maths is a core subject and high stakes tests

Last of all...

- Would you do it all again?
- Is there anything that you'd do differently?
- Is there anything else that you'd advise someone thinking of doing something similar in the future?
- Was there anything else that we should have asked you/ that you were expecting to be asked?

THANKS-VERY MUCH FOR YOUR HELP!

3. Interview schedule for network/project case study visits

Case-study visits to the NCETM networks

BACKGROUND TO THE CASE STUDY VISITS

Our final report will focus on the general issues emerging from the questionnaires and telephone interviews.

However, for the report we wanted to also feature case-study 'vignettes' of 8 particularly successful projects. So ... we'd be looking to visit you for an hour at some point in the day to do the following things

1. To make sure that our descriptions of your Network/project activities are accurate
2. To have a look over any material/resources/outcomes
3. If possible/appropriate, to have a brief chat with any other participants in the project/network

Suggested timings for the visit

- 30 min with the lead to video the excerpts, make sure the description of the Network is accurate and look over any other material
- 20 min group chat (focus group interview) with participating teachers (if any are available)
- 10 min group chat with participating students (if any are available)

Structure of case study report [two sides of A4 max!]

DESCRIPTION OF THE NETWORK [one paragraph]

- *Mathematics Topic*
- *Teaching & Learning Context*
- *Education Sector and Stage*
- *Time-line and frequency/intensity of activities.*
- *Description of activities*

WHAT BENEFITS WERE ACHIEVED BY THE NETWORK? [one paragraph]

[highlight & describe the three main outcome & benefits suggested areas include!]

- Increased teachers' learning in terms of subject knowledge / teaching practice/ pedagogy
- Gave teachers new ideas / resources
- Encouraged reflective practice
- Allowed teachers to engage with colleagues/peers that they would have not otherwise collaborated with
- Helped teachers to form a network of like-minded colleagues for future support and collaboration
- Provided teachers with a useful source of emotional support
- Strengthened teachers' motivation with regards to teaching maths

- Strengthened teachers' confidence as maths teachers

WHAT DO THE SCHOOLS SAY?

[three or four direct quotations/ soundbites]

'Lead' experiences of the Network.

Teacher experiences of the Network.

Students' experiences of classroom activities resulting from their teachers' Network-supported development.

'CONDITIONS FOR SUCCESS'

- What are the factors and issues underpinning the successful implementation of the Network?
- What are the factors and issues underpinning the sustainability of the Network?
- What were the barriers and impediments to success and sustainability ... and what were the corresponding strategies for overcoming these barriers and impediments?

Supporting documentary material relating to the individual Network

Pictures/ handouts/ images

Short videos will be made of network leads offering brief 'How To' testimonials and guidance for future network leads

[explain] It is also hoped that these case study projects can be featured on the NCETM website in a series of 'How To' guides for other teachers - offering practitioner-friendly advice, guidance, advice and inspiration for the setting up of future networks by teachers/schools.

video four very brief (30 seconds?) 'talking head' excerpts around the following questions....

- * 'What we did in our network/project'
- * 'What we gained from our network/project'
- * 'How we kept the network going'
- * 'If there's one piece of advice that I'd give to anyone planning on doing something similar in the future ...'