NCSL National College for School Leadership

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Account of practice

What are we
learning about...?

'Making mathematics count' in school networks

Developing a networked thinking maths group

Bedfordshire Schools Improvement Partnership

An illustrative example of what effective network practice for improving teaching, learning and leadership in mathematics looks like in action.

Networked Learning Communities

learning from each other | learning with each other | learning on behalf of each other

Developing a networked thinking maths group

The accounts of practice presented within this series are generated from the work of practitioners involved in school networks. They aim to reflect the best of what is known from networked learning in action in order to provide concrete examples of networked learning practice. In particular, they provide a practical illustration of the significant elements we have found to be evident in school learning networks when developing network practice for effective teaching and learning in mathematics.

> ***"Across the country, teachers of mathematics have been teaching, enquiring and learning together. By creating subject-specific learning networks, they are finding ways to solve some of the problems currently facing the profession. More importantly, they are improving the learning experiences of children in classrooms and schools, and in a diverse range of contexts nationwide"***

There are now many schools, both in the UK and internationally, that are benefiting from working together as a network. By drawing upon their experience, and from the range of research that has been undertaken in school networks, it is possible to identify how networks of teachers are helping to address three key issues associated with effective teaching and learning in mathematics.

Three characteristics of network practice for effective teaching and learning in mathematics

1. ***Doing mathematics together in networks to enhance specialist subject knowledge and increase the supply of confident teachers of mathematics.***
2. ***Planning and working together in networks to ensure that the current and developing mathematics curriculum, assessment and qualifications framework meets the needs of all learners.***
3. ***Problem-solving and learning together in networks to provide the infrastructure required to support mathematics teachers effectively, particularly in terms of their continuing professional development.***

The four accounts in this series explore in different ways and with differing emphases the characteristics of effective network practice for improving and developing effective teaching and learning in mathematics. Consideration of these factors when developing learning networks of mathematics teachers and other mathematics practitioners will help ensure that future development is built from the best current thinking and practice. We hope that these accounts of practice will, therefore, be of practical use to you – if you are considering setting up a network, are part of a newly formed or established network, or if you are simply interested in finding out more about making mathematics count in school networks for the benefit of both teachers and children. □

Acknowledgements

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Nick Martin & Non Worrall
Lead Developers

First steps: laying the foundations

❝ No curriculum can be regarded as acceptable unless it can be shown to make a contribution to the teaching of thinking. ❞

Robert Fisher, 1990

This account of practice outlines the story of the Thinking Maths Group, designed to introduce innovative thinking skills into mathematic teaching. During the last four years, the network has grown from being led by one consultant to having three members of the group sharing the leadership. The Thinking Maths group exemplifies how it is possible to change from centralised to de-centralised model of leadership and introduce new practice through planning, working and learning together.

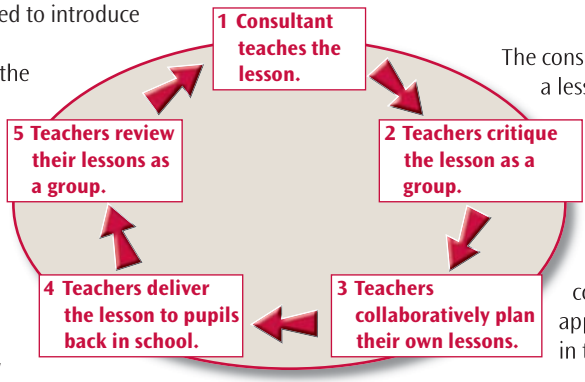
The Thinking Maths Group started its journey in 2001, when a numeracy consultant worked out a possible solution to the challenge of introducing thinking skills effectively into the Key Stage 3 (KS3) mathematics curriculum. Bedfordshire Local Authority has a three-tier system of lower, middle and upper schools and hence KS3 is split across two phases. To bring about change in this context therefore involved working with a wide range of people, from specialist mathematics teachers from the upper schools, to middle schools teachers for whom mathematics is only one of many subjects they have to teach.

With the energetic support of a key facilitator from the Bedfordshire Schools Improvement Partnership (BSIP), the consultant convened a group of mathematics teachers from the middle and upper schools. The group met for half a day each half term. The first meeting of the group was held at Insys, a local company keen to support local schools. They provided a venue, facilities and lunch, making it possible not only to launch the initiative but also to enhance the teachers' sense of being valued by the local business community.

From the outset the group used an approach dependent upon the teachers being placed in the position of learners. They drew upon innovative ideas being developed by Sally Taverner of Newcastle University, who was translating the groundbreaking work done in geography by her colleague, David Leat.

❝ It was great to receive an example of a new idea and then be given time to try it and develop one of my own – to get a real understanding of what it is about and see its potential. ❞

TMG member



The consultant began by teaching a lesson to the group, using a particular thinking skills technique. The teacher learners then critiqued the lesson and through a process of reflection and review, decided collaboratively on how best to apply the particular technique in their own contexts.

Working together, they devised clear and detailed lesson plans which they could take away to try out in their own classrooms.

There was a strong focus on using the plan as soon as possible – preferably within a couple of weeks – so that the learning was still fresh in their minds.

❝ Using ideas and information from the Thinking Maths Group, I have added thinking skills to schemes of work, department training sessions and delivered a whole-school workshop on thinking skills. ❞

TMG member

This model of *plan, do, review* has continued over the succeeding years, but the sessions have evolved as the group has matured and as leadership has changed. For example, far more members of the group now present and the sessions cover a much wider range of the mathematics curriculum. Each session now has regular time slots for:

- teaching oral mental starters
- decision-making activities
- 'website of the month'
- recommending books worth buying
- sharing teaching resources, including non- traditional resources such as photographs, video and music etc □

Planning, working and doing mathematics together

One of the immediate benefits for teachers who joined the Thinking Maths Group was the opportunity to 'do mathematics together'. Working away from their schools, and particularly initially in a business environment, with the time to think and reflect on their classroom practice in the company of other like-minded practitioners, proved a powerful lever for change.

Building risk-taking

Perhaps the most significant factor in generating a risk-taking approach was the choice of a focus that placed everyone in the position of learning a new skill – there were no experts. Combined with working with colleagues from other schools, this generated an open atmosphere where difficulties and failures could be shared and learnt from. The BSIP facilitator said: "From day one, the co-leaders openly admitted to making mistakes when trying new approaches. This modelled to the group that it was OK to admit to failure and to learn from mistakes. This is now a regular part of each session."

In-school support

A key factor in the success of this subject-specific network has been the continuing willingness of the headteachers to release their teachers to participate. They have prioritised their staff professional development, seeing the networked solution as an effective investment. "My school knows that I need this. I love maths and I love teaching maths but as you get higher up the scale you can get bogged down in management issues. Membership of this type of group is what keeps you going." TMG co-leader

Dissemination

As the network has continued to develop, the group members have involved other colleagues in their deeper exploration of innovative ways of teaching and learning mathematics. One teacher remarked: "Whenever we attend a TMG session we always feed back to our departments. Members of my department try the ideas and further develop them, and I bring their ideas back to the group. The children also talk to each other and sometimes they can even pressure their teacher into trying some of the ideas."

Selecting the focus

The teachers select a focus by choosing areas where traditional teaching methods are not working. They then develop a completely new approach using one of the thinking skills methods: information processing, reasoning, evaluation, enquiry or creative thinking. The pupils are intrigued by the different approach: "You can see them thinking, 'Hey this is really good because we're drawing pictures or doing drama.' Only at the end do they realise, 'Oh it's that boring topic again' – but it's too late because you've already got them." TMG co-leader

An example

The first activity which the Thinking Maths Group devised collaboratively, Mystery, was designed to teach pupils how to select the relevant data to solve a problem. It needs little explanation and is appropriate for most ages. Mystery begins with 18 statements printed on individual slips of paper (see next page). The activity is designed for groups of about four. The pupils share out the 18 comments and then work together to decide whether the Hunter family should go to the Canaries or a holiday park for their annual holiday.

Teamwork is important, with the emphasis being on how agreement is reached. Some of the statements can be interpreted as being both in support of and against one of the destinations. The discussion means that pupils develop the ability to sort relevant from irrelevant information. They also learn to classify and interpret information, make links between pieces, form hypotheses, check, refine, explain and justify.

Although common in humanities lessons, such activities also have much to offer to the discipline of mathematics where pupils are often only given the data necessary to solve a problem, but their thinking skills are developed further if they have to select the necessary data before starting. Pupils also learn how to make and justify a decision to which there is no 'right' answer, which for many pupils is a new and liberating experience in mathematics. □

A Mystery lesson

Mystery begins with 18 statements printed on individual slips of paper - Photocopy this page.

All of Rebecca's friends are going abroad this year.	*Jack likes all sorts of sports including football, swimming, snooker and especially tennis, all of which are available at the holiday park.*	*Rebecca wants to go back to school in September with a tan.*
Mrs Hunter thinks this could be their last holiday as a family. She thinks Rebecca will want to go on holiday with her friends next year when she starts in the sixth form.	*Mr Hunter would prefer not to fly.*	*It will cost about £8 a day to put HP into kennels.*
They have saved £60 a month for the last year.	*Rita has seen a holiday in a travel agents for 10 days' B+B in a hotel in the Canaries for £300 each; children under 16 go half price.*	*Bob says when they went to the holiday park nine years ago, it was about 150 miles away.*
Bob reckons their car does about 30 miles to the gallon.	*Petrol is about 82p a litre.*	*The average temperature for the Canaries during August is about 28C.*
Rita has only 15 days' holiday left to take until January.	*Bob reckons HP is getting a bit old at the age of nine to be going into kennels.*	*Rita says they normally spend about £100 a week on food.*
Bob got Jack to go on to the Holiday Park website and found an apartment for two weeks self-catering based on a family of four sharing, for £950. This included free access to the swimming pool, but things such as tennis were extra and charged by the hour.	*£1 is approximately 1.6 euros.*	*Rita's work colleague Ardvind says he took his wife and daughter to the Canaries last year and the food was very reasonably priced. They spent about 30 euro a day on food and about one-and-a-half times that amount on entertainment.*

What difference is it making?

Following the success of the Thinking Maths Group, BSIP extended the model to 26 Professional Study Groups, some of which are subject based but many cover cross-curricular issues or groupings of children such as 'gifted and talented'.

In 2004, the network decided to commission an evaluation of the outcomes of this way of working. Using Checkland's (1981) soft systems methodology, they set out to discover the impact of professional study groups on the teaching and learning and subsequent attainment of students in the classroom.

Volunteers from the Thinking Maths Group taught focus lessons including activities developed by the group. They and their students completed questionnaires designed to map their experiences and reactions.

The evaluation used the criteria mapped by DeBouer (2004) et al's study of the improvement of mathematics teaching and learning through professional development:

- giving students a clear sense of purpose
- taking students' existing ideas into account
- use of real-world examples
- understanding and application of new ideas
- promoting thinking about learning
- student self-assessment feedback to teachers
- enhancing learning environment

Impact on teachers

The interim findings of the evaluation indicate that: membership of the Thinking Maths Group encourages the exploration of innovative and creative approaches to teaching and learning. It is proving an efficient way of enabling teachers to share and develop high quality teaching resources and networking links.

" I have trialled the mystery activity and so have my colleagues. I have used the classification activity and we are now developing our own classification for fractions, decimals and percentages and for equivalent algebraic expressions. "

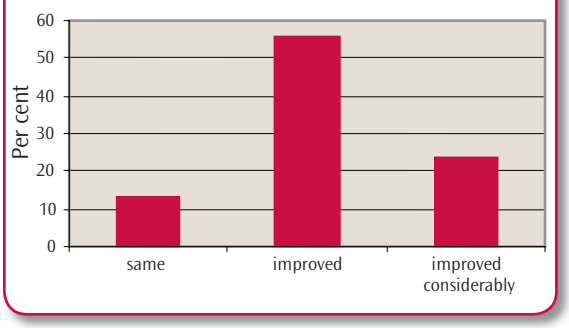
TMG Member

Impact on Pupils

According to one of the TMG members, "Pupils enjoy the lessons which leads to greater confidence in answering questions, which leads to improved attainment. Teachers enjoy teaching and sharing the ideas, which leads to greater sharing, which means less individual work, which leads to more energy in the classroom and better teachers."

The pupils' responses on the questionnaires showed that thinking skills approaches in maths lessons were enjoyable, helped them to learn and made them want to find out more. They also indicated that, in their opinion, these different types of approaches improved their mathematical understanding:

Figure 1 How much did the thinking skills activities improve children's understanding?



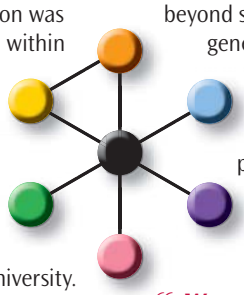
" Some of my students take the ideas and create more resources for other classes. They then have ownership over the lesson and don't just see me as the teacher and them as the students. "

TMG co-leader

The network is continuing its evaluation, tracking the impact on all those concerned in the collaborative enterprise. The Local Authority has recently moved to a model of seven learning communities. BSIP's evolution of professional development groups is proving a significant and differentiated vehicle for CPD that benefits all learners – adults and children. □

End note

The learning journey continues… In February 2003, when the Local Authority consultant moved on, the network was robust enough to reconfigure itself. Following reflection and discussion, the corporate decision was taken to have three co-leaders identified from within the group – the current co-leaders being a leading maths teacher from one of the middle schools, and an advanced skills teacher (AST) and a curriculum manager from two upper schools. The meetings have continued to occur on a half-termly basis but the group now has access to the facilities at the Networked Learning Group at Cranfield University.



"Changing location was a real turning point for the group. We really feel like it is our group now."
TMG co-leader

Initially, this network exemplified the configuration of a centralised model, with the Local Authority numeracy consultant acting as the central hub. As time has passed, the pattern of communication and responsibility has changed, reflecting the maturity of developing connections. The growth of social capital amongst the members has enabled members to draw on each other's strengths, making connections beyond the original group as well as within it.

Whereas the original membership largely consisted of more experienced teachers, increasingly the membership has changed to include less confident staff who benefit enormously from planning, working and doing mathematics with other practitioners. The network can now be represented as a multi-centred, multi-connected model.

"The consultant used to provide all the ideas. When he left we had to develop our own materials which meant we took ownership of them – the successes and the failures."
TMG co-leader

Under new leadership the group has continued to go from strength to strength. The teachers have brought about change in their own Local Authority – impacting on the design of the 26 other Professional Study Groups. But also six of the group recently took part in developing materials for the 'Leading in Learning' programme, part of the KS3 Strategy's support for whole-school improvement. A systematic, research-based programme, focused on improving pupils' thinking skills in curriculum subjects, Leading in Learning, takes a cross-curricular approach. It is deliberately structured so that teachers and pupils look beyond subject confines to thinking and learning more generally. There is a focus on specific thinking abilities and metacognition to encourage systematic development of thinking skills to aid transfer of learning across subjects and into other aspects of pupils' lives.

When asked what was next on the horizon for the network, one of the co-leaders replied:

"We never know what's coming round the corner, but we will definitely keep evolving as a group and continue to develop new and exciting ways to teach and learn mathematics." □

Further information

Checkland, P, 1981, *Systems Thinking, Systems Practice*, Chichester, UK: John Wiley & Sons

DeBoer *et al*, 2004, *Research Issues in the Improvement of Mathematics Teaching and Learning through Professional Development,* American Educational Research Association (AERA,) San Diego, California

Fisher, R, 1990, *Teaching Children to Think,* Oxford, Blackwell

www.standards.dfes.gov.uk/keystage3/subjects/maths/

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The first nine titles in the series will focus on:
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- LEA involvement in school networks
- Establishing a network of schools
- Community leadership in networks
- ***'Making mathematics count'* in school networks**
- The impact of school networks
- Sustaining a network of schools
- Facilitation within school networks
- Professional development in school networks
- Leadership of school networks

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