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Think piece

What are we
learning about...?

'Making mathematics count' in school networks

Finding the path to further progress...

Mathematics in Primary Strategy Learning Networks

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Networked Learning Communities

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

Finding the path to further progress...

Mathematics in Primary Strategy Learning Networks

The latest *Trends in International Mathematics and Science Study* (TIMSS) reveals that the mathematical attainment of England's Year 5 pupils has risen well above the international average, and is only a little behind the highest performing countries in the world. The improvement is by far the biggest rise for any country for the period 1995 to 2003 and is across the attainment range.

TIMSS results for England

The international benchmarks in the 2003 *TIMSS* were classified as advanced, high, intermediate and low.

- The advanced benchmark was reached by 14 per cent of pupils:
  - higher than the international average of eight per cent
  - just above the comparison group average of 12 per cent
- The proportion of English pupils reaching all of the benchmarks increased significantly from 1995
- The proportion reaching the advanced benchmark increased most, doubling in size

NCES, 2004

Key Stage 2 results show a similar pattern. Whilst there has continued to be progress in the proportion of children achieving level 5 – 17% in 1997 to 25% in 2001 to 31% in 2004 – there has only been a one percentage point increase in the number of children achieving level 4 from 2002 to 2004. These figures suggest that teachers will benefit from the opportunity to develop their skills and understanding when working with children who are finding aspects of their learning in mathematics problematic.

Primary schools, and individual teachers, have done exceedingly well to raise attainment in mathematics so significantly. But the job is incomplete. The difficult question is 'where is the further progress to be made?' Will it be through focusing on specific groups of children, or by improving teachers' subject knowledge, or from greater attention to, and understanding of, progression within the subject?

This think piece explores the pedagogic and infrastructural issues with which teachers are currently faced as they look towards raising attainment in mathematics still further. It addresses the important question of how a path to further progress might be found through the creation of learning networks which give teachers access to both subject and pedagogical expertise in mathematics. In outlining the possibilities and potential which learning networks present, the benefits of collaborative working are highlighted as having particular relevance for the learning and teaching of mathematics. In particular, learning networks are identified as providing the infrastructure to support the continuing professional development (CPD) of teachers of mathematics where secure subject knowledge and effective pedagogy can be developed through the involvement in collaborative networked learning opportunities.

In the light of this discussion, the paper examines the importance of developing a compelling idea and defining a sharp pupil learning focus as the unifying factors in motivating people to work together. It provides some practical suggestions as to the sorts of questions it is helpful to ask in sharpening your pupil learning focus in mathematics. It also points to the importance of ongoing evaluation to provide evidence of progress and the impact of network activity on staff and pupils' learning. □

Working together in learning networks

Professor Adrian Smith's report *Making Mathematics Count* (2004) looked at issues affecting mathematics at post-14. He recognised the importance of primary school children securing a good mathematical understanding before they moved into the next stage of their education. A significant focus in the report is on current provision for continuing professional development in mathematics. In his response to the report, the Secretary of State set out a commitment that all teachers would have access to three aspects of CPD.

Three aspects of CPD which will enable teachers to:

1. develop a depth of mathematical subject knowledge to underpin teaching and learning
2. enhance their repertoire of mathematics subject-specific teaching methods and pedagogy
3. apply general strategies for teaching and learning in mathematics

This commitment recognises that secure subject knowledge and effective pedagogy are both essential for high quality teaching and learning in mathematics to take place. It echoes the findings of the *TIMSS* study that indicated that whilst the Year 5 children performed above the average in 'data' and 'geometry', and at a similar level to overall performance in 'measurement', they were relatively weak in 'number, patterns and relationships'. The evidence indicates that an essential focus for teachers' CPD activity will be developing an understanding of the number system and the patterns and relationships that are crucial to mathematical understanding.

In addressing the practical task of giving teachers of mathematics access to these aspects of CPD, the Primary National Strategy is offering the opportunity, through Primary Strategy Learning Networks, for teachers to have access to subject and pedagogical expertise within mathematics. Additional funding has been made available to those networks which identify and foster mathematical expertise as their pupil learning focus.

Some of the benefits of working collaboratively include:

- teachers working together to exchange ideas and share good practice
- increased opportunities for staff training and professional development
- enhanced teacher confidence due to support from colleagues
- wider curriculum choice for children
- smoother transition, where this was part of the project

NFER, 2003

These benefits have particular relevance for the learning and teaching of mathematics. All primary school teachers are teachers of mathematics and yet many of them find mathematics a difficult and challenging subject. The benefit of meeting with colleagues to exchange ideas and share good practice cannot be over-emphasised. Thoughtful professional discussions with colleagues can develop teachers' confidence so that they will be prepared to try a new teaching strategy or to probe more deeply with their questioning. Teachers also find the identification of shared difficulties and possible solutions a supportive reinforcement of their own professional judgement.

One of the important outcomes of teachers talking together is the growing awareness, for individuals, of their own professional development needs. Many teachers highlight their own lack of subject knowledge as a development need. However, for all teachers there is the realisation that exploring pedagogical issues will help them to gain a greater understanding of the process of learning and teaching mathematics.

Teachers who are confident in their ability to teach mathematics effectively will give their pupils wide and varied experience with mathematics. They are also likely to take mathematics as one of the key contexts when considering the wider curriculum. This ability to exploit mathematical opportunities in all areas of the curriculum will help children to put their mathematical learning into context and to see the co-ordinated or coherent nature of the curriculum, as well as its diversity. □

Who does what?

Leading and advanced skills mathematics teachers

It may be that one, or more, of the network schools has a leading or advanced skills mathematics teacher on the staff. The expectation is that this teacher would be able to share expertise across the network. This may be through activities such as: organising workshops around the network's focus area; visiting colleagues in their classrooms; inviting colleagues to observe them teaching and engaging in shared observations. Leading and advanced skills mathematics teachers will also need support from local authority colleagues or other external experts to help them to fulfil their role effectively.

Networking for mathematics co-ordinators

All of the network schools will have a teacher whose role it is to co-ordinate mathematics. These teachers will have varying amounts of experience and competence. One of the important aspects of the network will be to provide opportunities for the co-ordinators to work together around the identified learning focus in order to support each other. It may be that they will identify their own training needs to enable them to support the teachers in the network schools more effectively. Peer coaching has been identified as one of the most effective tools available for fostering CPD (Cordingley *et al,* 2003) and may well feature in the work of the mathematics co-ordinators.

Classroom assistant networker

Classroom assistants perform an increasingly important role in many mathematics lessons. Some of them are employed to support children with identified learning needs and those with a wider brief are often supporting groups of children who are having difficulties with their learning. The development of activities to support classroom assistants' own knowledge of mathematics and their understanding of teaching strategies, has the potential to enhance the learning experience for some of the most vulnerable groups of children. Leading and advanced skills mathematics teachers, mathematics co-ordinators and various outside experts may have a role to play in supporting the development of classroom assistants.

Contacting an outside expert

This might include experts such as a teacher from outside the network or a local authority consultant. No network exists in a vacuum. It is important at the planning stage to identify expertise within the network and to recognise when it will be necessary to bring in support from outside. It may also happen that, as the work of the network develops, unexpected requirements for outside support arise. It is important to know who is available and to recognise the importance of using the help appropriately. One of the advantages of learning networks is this use of external expertise across a group of schools, which is both high impact and cost-effective. □

Which 'compelling idea' should a network focus on?

Sharpening your network's pupil learning focus

It is important to identify a learning focus that is grounded in the work of the network's schools. A pupil learning focus that has resonance for all the adults in the network will be a unifying factor that will motivate people to work together. The present agenda in mathematics suggests that there are particular areas that networks need to consider. These are broad areas that will need to be refined in order to establish a sharp pupil learning focus.

Six broad areas of mathematics to consider as the starting point for establishing a network pupil learning focus

1. The effective use of ICT in the teaching of mathematics
2. Talking mathematics
3. Assessment for learning in mathematics
4. Exploiting mathematical opportunities across the curriculum
5. Hard bits of mathematics
6. Working with specific age groups

A pupil learning focus lacks sharpness when it is over-complex or too broad, it is disconnected from the network's other key activities, it is based on shaky foundations, or it only deals with the tip of the iceberg (NCSL, 2004). The planning process is, therefore, key as it provides the opportunity to explore the issues in depth.

What follows are some questions that might be asked in identifying one of the broad, yet focused, areas listed above as a learning focus. The answers to the questions will begin to identify possible actions. If an answer to any of the questions is 'no' then subsequent questions will need to be considered before a truly sharp focus can be identified. Even this should not be considered as the final focus as the process of working through a network action plan might well reveal deeper levels of necessary work.

1 *The effective use of ICT in the teaching of mathematics*

- Do the adults in our schools have the confidence to use technology?
- Is there a clear view of how technology can enhance learning?
- Do we use ICT in a way that is appropriate to the age of the children?
- Are we fully exploiting the ICT resources we have?

2 *Talking mathematics*

- Do the adults have the necessary mathematical understanding to support meaningful dialogue and enquiry?
- Are the teachers confident in the management of interactive teaching sessions?

3 *Assessment for learning*

- Do the teachers have the necessary subject knowledge to enable them to identify misconceptions and to help children to overcome them?
- Does assessment for learning inform planning?
- Does assessment for learning focus on process as well as outcome?
- Does assessment for learning in our schools give children ownership of their own learning?
- How are informal assessments recorded? – is the process clear and supportive of teachers?

4 *Exploiting mathematical opportunities across the curriculum*

- Do teachers appreciate that this is not just an old idea and that it doesn't mean 'back to topics'?
- Do teachers have the confidence to exploit opportunities as they arise?
- Do teachers have the subject knowledge required to enable them to exploit the opportunities for teaching mathematics across the curriculum?

5 *Hard bits of mathematics*

- Are the teachers confident about teaching these conceptually difficult ideas?
- Is there a range of useful models and images used in our schools?

6 *Working with specific age groups*

- Are movements between key stages and year groups smooth with no apparent drop or stall in achievement?
- If we concentrate on particular year groups, how do we engage all members of staff in the work of the network? □

How do we know it's working?

Evidence of impact on staff learning

Network action plans should identify criteria for assessing the work of the network. Teachers and classroom assistants may have engaged in development activity, but how will the impact of this activity be identified? Success criteria that relate directly to the learning focus will help to clarify not only the evaluation process, but also the understanding of the adults as to the purpose of the work of the network.

So, a statement such as: 'the teachers know how to talk to the children in order to ascertain their thinking and level of understanding' will help teachers to be clear about the expected outcomes of their professional development. Less easy to quantify will be an increased level of confidence in, and understanding of, the teaching of mathematics. However, where classroom observations indicate that teachers are authoritative in their explanations and adventurous in the teaching strategies they use, it may be possible to make a qualitative judgement.

Evidence of impact on children's learning

Children also need to be aware of the purpose of the network and clear about what is expected of them. The identification of clear success criteria in an 'I can do' format will help children to recognise the focus of their learning, for example, 'I can explain the grouping model of division.'

Where the work of the network is having an impact, classroom observations will indicate that children are confident in the area of mathematics that is the network's focus. They will be keen to talk about their work and have the ability to do so with understanding. They will be lively and interested in mathematics lessons and able to frame purposeful questions. Additionally, results in end of key stage tests and other surveys will show that the children's level of attainment has risen compared to previous cohorts. □

End piece

The TIMSS (2004) research and Adrian Smith's report *Making Mathematics Count* (2004) identify national issues and give indications of areas of mathematics where networks might usefully focus their attention. Primary Strategy Learning Networks will engage in developing areas of mathematics teaching and learning where they identify a specific need. They will seek to develop the knowledge and expertise of the adults in the networks' schools in order to support the development of effective teaching and learning. However, their work will also become part of the national intelligence about the effective teaching of mathematics that will drive future developments. □

References

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