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Think piece

What are we
learning about...?

'Making mathematics count' in school networks

Turning the tide back towards mathematics

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Networked Learning Communities

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

Turning the tide back towards mathematics

Professor Adrian Smith's report *Making Mathematics Count* (2004) identifies three key areas of concern in mathematics education. The third area involves professional development for practising teachers, stating that there is *"a need to support, sustain and enhance current teachers of mathematics through CPD and other teaching and learning resources."* This report recognised that the level of mathematical skills and knowledge of the general population will increase only if there are sufficient well-qualified mathematics teachers in schools and colleges. One of the ways of reaching this state is through the provision of quality programmes of continuing professional development (CPD) for practising teachers.

This think piece explores the theme of networked CPD using illustrative examples from the pilot of a 10 day programme of professional development involving mathematics teachers in three London Local Authorities. The design of the programme was informed by the evidence that *sustained* and *collaborative* professional development has a positive impact on teaching and learning (Joyce & Showers, 2002). The programme was planned in collaboration with the users and set out to integrate teachers' own learning of mathematics with the development of an enhanced understanding of mathematics pedagogy.

All teachers on the programme, including those with strong subject knowledge, are expected to work on their own mathematics. The programme is divided into six face-to-face tutored sessions and four mentored school-based days. This sustained period of professional development aims to encourage teachers to adopt a reflective approach to their practice, when they try out in the classroom what they have been learning in theory. An underlying principle of the design of the programme is that teachers are encouraged to develop their practice through collaboration in small network groups which bring together teachers across different schools and Local Authorities, drawn by a common interest or concern. From the outset, there was also an expectation that successful network groups would continue to function after the 10 days of the programme had been completed. In this way, the programme aimed to build local capacity amongst networks of teachers, to provide an additional resource to support the further development of the programme in scaling-up to reach a wider number of schools and Local Authorities.

This think piece draws upon the experience of designing and implementing a mathematics CPD programme. It explores the components of effective professional development and highlights the importance of teachers collaborating in networks or learning communities.

It then draws upon further illustrative examples to outline the strategies and approaches that can be used to facilitate mathematics teachers working together in networks, across departments in schools and across schools and Local Authorities. □

Teachers developing their practice by working together

For many teachers, the greatest gain from attendance at a professional development day is the opportunity to network with other teachers. How many times have we heard or read comments from teachers similar to those below?

“ It was great getting to work with other teachers, particularly those from other schools. ”

“ The best part was having time to share and learn with other mathematics teachers, where mathematics learning and teaching was the only focus. ”

Normally, despite good intentions, these network links between teachers do not continue once teachers have returned to their individual schools and classrooms. However, the words above were some of the comments written by teachers who had attended the 10 day professional development programme at the London Mathematics Centre. These teachers recognised what they had gained professionally and mathematically by working together with colleagues. Because of the length of the course and the requirement for teachers to work together on school-based investigations, many of the networks formed have continued beyond the life of the CPD programme.

The evidence shows that one of the key conditions for teacher development to impact on future teacher practice and hence on student progress, is that it allows a community of professionals to network. This community of professionals must *”come together to study together and put in practice what they are learning, and share the results”* (Joyce & Showers, 2002). To consider in more depth the connection between professional development programmes and impact on student progress, Bruce Joyce and colleagues have studied a large number of different training programmes. They assessed the impact of the training on the teachers’ acquisition of new knowledge and skills and they also looked at the teachers’ willingness to adapt their practice as a result of the training. They found that if the delivery of training was good and teachers were provided with excellent demonstrations and given opportunities to practise, then about 60 per cent of the teachers attending the training improved their knowledge and skills. However, only five per cent would be implementing what they had learned after a period of six months.

This research shows that only if the training actively promotes teachers working together in small networks or peer coaching groups will there be any impact on changed practice and student achievement. Joyce and Showers note that implementation depends not only on increased knowledge and skills but also on *“the companionship provided by peers as the new knowledge and skills are used to change the students’ learning environment”.*

We all know how much easier it is to try out new ideas when there is a fellow teacher who will think through these ideas together and who will provide companionship in the aftermath of a lesson that possibly did not progress as well as expected. A companion will provide more objective feedback. So working together is not only an enjoyable, but a necessary part of teacher development. In this regard a peer coaching approach can be a useful strategy to adopt in supporting the process of collaborative working within a networked context. A peer coach is a supportive peer who works together with the teacher on planning and implementing the knowledge and skills gained as part of the training. A peer-coaching group can be made up in many different ways.

Examples of peer coaching groups

- teachers from different schools who are working together on a professional development programme
- teachers from a mathematics department in a school who are working together on a particular issue
- a development group made up of teachers and, for example, a Local Authority consultant or researcher □

Pause for thought...?

How might you utilise peer coaching within your professional practice?

Teachers are working together in network groups

As Professor Smith reported in *Making Mathematics Count*, there is an urgent need for mathematics teachers to gain access to quality programmes of professional development. However, as was shown above, a professional development programme will only impact on teacher practice and pupil achievement if it includes opportunities for teachers to work with a network of peers. This then poses the question: how can the networking of teachers be facilitated and what is it that will prompt teachers to get together even with heavy timetables and demanding classes?

One of the answers is teachers working together doing mathematics with the support of an 'expert'. Very few mathematics teachers engage in mathematical activity for its own sake. How often do pupils see their mathematics teachers doing mathematics and showing that they themselves need to think mathematically? Teachers of art and music nearly always engage in artistic and musical activity in and out of school, English teachers read and write literature and act in drama. Doing mathematics together can become an excellent focus for a network group. The report *Making Mathematics Count* made it very clear that mathematics is special and important, and that pupils need the opportunity to see the value of mathematics for its own sake.

> ***"Mathematics provides a powerful universal language and intellectual toolkit for abstraction, generalisation and synthesis. It is the language of science and technology. It enables us to probe the natural universe and to develop new technologies that have helped us control and master our environment, and change societal expectations and standards of living. Mathematical skills are highly valued and sought after. Mathematical training disciplines the mind, develops logical and critical reasoning and develops analytical and problem-solving skills to a high degree."***
>
> Smith, 2004

Pause for thought...?

How might you engage in doing mathematics together with colleagues in your context?

In order to help all students gain access to the powerful language of mathematics, Professor Smith suggests that teachers need to enjoy doing mathematics. He adds that "developing a depth of personal subject knowledge to underpin teaching and learning" must be a component of all programmes of CPD in mathematics. He notes that this is valuable for all teachers, even those who are already well qualified in mathematics.

But how can mathematics teachers work effectively together? There are many opportunities for teachers to get together to work on their mathematics in order to strengthen teaching and learning. Below are a number of examples.

A mathematics department working together

A school mathematics department identified an area of concern in its teaching of data handling at Key Stage 4. The teachers hoped that the resources from the *Census at Schools Project* (www.censusatschool.ntu.ac.uk) and the publication, *A Toolkit in Data Handling for Projects,* both developed by the Royal Statistical Society (RSS, 2003), would help them strengthen their own understanding of data and help them exploit more fully the excellent ICT resources in the City Learning Centre attached to the school. However, no one teacher had the time or confidence to learn how to use the whole resource. The head of department divided the work into sections and asked each teacher to take responsibility for the preparation of his or her section. Teachers were asked to work in pairs and to select the section in which they lacked confidence. Hence each teacher was having to learn something new. Each pair gained familiarity with the resources, tried out all the activities, found out how to use the IT and tried out some of the activities in the classroom. At the end of two weeks, each pair reported back to the full department. As one teacher said, "*We only had to work through a fifth of the book but we now all know all of the content and what works and what does not in the classroom.*"

Teachers, mathematicians and mathematics educators working together

In 2003-4, the Qualifications and Curriculum Authority (QCA) set up six working groups to investigate the teaching of reasoning in school mathematics. The task of the working groups was to explore different aspects of "developing reasoning through algebra and geometry". What was innovative about the structure of the groups was that they created networks of teachers, mathematicians, mathematics educators and Local Authority mathematics advisers. The thinking, the uses for ICT and the classroom activities suggested by the working groups have been enriched by the cross-fertilisation of knowledge and experience between mathematicians and classroom practitioners. Many of the ideas in the published report (QCA, 2004) are available for networks of teachers and researchers to develop further.

Pause for thought...?

How could you tap into opportunities for networked CPD in your context?

Teachers across a Local Authority working together with a consultant

The National Key Stage 3 Strategy has published a range of materials for schools, helping teachers to rethink the teaching of key areas of mathematics. The materials are disseminated to schools through local training. Many Local Authorities have realised that the most effective way of ensuring that the materials are used in the classroom is first to pilot the materials with a small network of teachers. This group of teachers then reports back on how they have integrated the activities into their schemes of work – 'this is how it worked in my classroom'. Without the feedback from peers, training, though well received, does not lead to action, the materials themselves remain unused and the planning is not integrated into the teachers' schemes of work.

Ways of working across schools

Teachers often benefit from sharing ideas and planning together with teachers from other schools. Other schools use different textbook schemes, have access to different IT facilities and organise their grouping of pupils in ways that might inspire new ways of thinking. Observing how another school has set about solving a problem or making better use of its IT resources in the mathematics classroom can be very useful. As one teacher on the London Mathematics Centre (LMC) 10 day programme noted:

"I didn't think that in my school set-up I would be able to teach the topic using geometry sketchpad on an interactive white board. Using the interactive white board was still too new for me and it would involve changing classrooms with another teacher. Then I went to see another teacher teach the lesson that we had planned together. I saw how she used the geometry package and the interactive white board. I could see how much the pupils were learning. I then knew that I had the confidence to change classrooms, use new equipment and teach in a more interactive way."

There are a variety of formal and informal ways in which teachers with a common interest can meet up to work together in a mathematics network.

Examples of opportunities for networked CPD

- Local Authority network meetings of heads of department
- Local Authority based training for the Primary and Secondary National Strategies
- QCA meetings and discussion forums
- training run by the examination boards
- research projects run by staff from Higher Education Institutions (HEIs) but based in schools
- curriculum development activities promoted by strategy, publishers or QCA
- collaborative CPD programmes

Teachers in network groups can work together using electronic communication. Gradually, schools are upgrading their equipment to include broadband internet links. To encourage teachers on the London Mathematics Centre's (LMC) CPD to talk to each other across schools and Local Authorities, we set up an internet-based discussion forum. Teachers were given entry to a password-protected site. Once into the site, teachers could start or continue a discussion theme and post files containing teaching materials, lesson plans or reflections. Teachers in the LMC used the site to work jointly on different activities.

Examples of activities undertaken within an online learning community

- On-going discussion around a particular mathematical problem or teaching issue: a discussion involving four teachers and an adviser debated how a dynamic geometry package could help pupils to reason in geometry without the lack of computer skills getting in the way of learning.
- Planning, teaching and reflecting on a lesson: three teachers worked together both face-to-face and remotely to plan, teach, reflect, revise and teach the revised lesson on circle theorems.
- Sharing curriculum resources: two teachers worked independently on strengthening the level of interaction and discussion in their AS teaching. They selected different curriculum areas and frequently posted their lesson plans and reflections for each other to use. □

End piece

Professor Adrian Smith's report has made it a priority for mathematics teachers to participate in programmes of effective Continuing Professional Development that will impact on student progress. Research provides evidence that professional development has more impact on the pupil when it is followed up by teachers working together in network groups and gaining support from an expert when needed. The London Mathematics Centre has provided some pilot examples of how effective networks can run.

The Key Stage 3 Strategy (now the Secondary Strategy) has provided schools with a rich set of mathematics resources for the classroom. These resources will only be fully accessible to students if teachers get together to work with them to make them their own. Teachers recognise that it is a very valuable privilege to be able to work jointly with colleagues in the classroom. However, teachers who have had the chance to undertake joint planning and teaching recognise that the benefits far outweigh the time needed. The last word comes from one of these teachers.

" When you are in a colleague's classroom and not teaching then you can focus your mind on the pupils. You can observe a pupil and see their understanding and why and what is giving them difficulty. This is not something you can do when you are teaching the whole class. "

We have seen that teachers enjoy doing mathematics and thinking about their teaching together in networks, and that this enjoyment and companionship is an essential ingredient in professional development programmes. Through this collabotative work we wish to turn the tide back towards mathematics in terms of both enhanced student achievement and improved teaching and learning, and see our able students electing to study the subject at A level and degree level, so potentiality contributing to the next generation of mathematics teachers. This means that policy makers and educators must make a place and time for teachers to work together in and out of the classroom and the technology must be fully exploited to facilitate easy communication. □

References

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Smith, A, 2004, *Making Mathematics Count: The Report of Professor Adrian Smith's Inquiry into Post-14 Mathematics Education*, London

Pause for thought...

Use this page to make notes and record your thoughts.

Pause for thought...?

1

***1** How might you utilise peer coaching within your professional practice?*

2

***2** How might you engage in doing mathematics together with colleagues in your context?*

3

***3** How could you tap into opportunities for networked CPD in your context?*

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