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Working in Partnership: Continuing Professional Development for Teachers of Mathematics and the role of the National Centre for Excellence in the Teaching of Mathematics (NCETM)

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I am very pleased to be able to write as the Director of the National Centre for Excellence in the Teaching of Mathematics (NCETM). I joined the organisation at what was a very exciting time: at the end of its first year when we planned to work hard to engage with a still wider group of teachers across all sectors. It was also a time of some positive change in mathematics education more generally, with a 7% rise in A Level entries, and 8% rise in entries to Further Mathematics – Further Mathematics was the fastest growing subject. Earlier this year, it was announced that in the latest Comprehensive Review of Government Spending, there will be £140m available over the next three years (2008- 2011) to improve mathematics and science teaching, an amount that includes continued funding for the NCETM. This long term funding is evidence of Government support for mathematics as at the heart of so much of education across all phases, and recognition of the importance of professional development for teachers of mathematics.

It is within this context that I believe the National Centre can have considerable impact on the teaching of mathematics in our schools and colleges, and on the engagement and enjoyment of learners. I am delighted with the progress we have made together, while being only too aware of the challenges we face if we are to achieve our aims. So what are our aims and what is the history of NCETM?

History and Vision

The NCETM was set up in England by the U.K. Government as a national infrastructure to provide effective strategic leadership for mathematics-specific continuing professional development (CPD). This is the first time such a national infrastructure has been put in place. The Centre aims to raise the professional status of all those engaged in the teaching of mathematics in order that the mathematical potential of learners will be fully realised. The National Centre takes as its starting point that effective CPD has three interrelated strands:

- broadening and deepening mathematics content knowledge;
- developing mathematics-specific pedagogy, which includes appreciating how learners engage with mathematics and likely obstacles to progression;
- embedding effective mathematics pedagogy in practice.

Thus we join with partners in the community to promote CPD opportunities for teachers that impinge on these strands in ways that are cumulative and sustained over the career of a teacher. Important among these partners are HEIs who are already offering CPD opportunities for teachers and who have expressed an interest in doing more with us. HEIs can provide expertise in mathematics and in mathematics education as well as bring new perspectives on the subject and effective pedagogies that will inform the work of the NCETM.

Key to the Centre's agenda are:

- its unerring focus on mathematics and developing excellence in teaching mathematics across all phases of education;
- its support for sharing successful practice within and across a range of didactical contexts from early years through to further education;
- its brokerage of a range of professional development opportunities while identifying and sharing evidence of their effectiveness;
- its commitment to placing teachers' needs and goals at the core of its work by putting in place structures through which teachers are able to develop ownership of its provision;
- its offer of a single, unified point of contact for teachers of mathematics, and
- its commitment to joining with partners to influence policy concerned with workforce development.

The Centre operates through a combination of face-to-face activity led by a team of Regional Coordinators, and through its online portal communities and interactive Professional Learning Framework. Through these means the Centre promotes a blend of approaches to effective CPD, which take advantage of the resources and communication tools made available on the portal.

In what follows I provide a glimpse of the NCETM's provision, the impact it is making and the challenges ahead.

Building the NCETM community through face-to-face meetings

The NCETM works with teachers face to face in a number of different ways. An increasing number of teachers are joining the NCETM events: for example, 1126 people attended NCETM events during November 2007. The highlight of that month was of course our national event on the 20th November at which teachers who were holders of NCETM grants came together to share their findings and their experiences. There was also a superb talk by Professor Nunes of the University of Oxford on the teaching and learning of fractions in which she was joined by Sue Dobbing from one of the infant schools where she had worked to give the teacher perspective – a wonderful example of mutually beneficial collaborative enterprise. In line with the NCETM's objectives, the day also had a policy agenda and participants had the chance to listen to Sir Peter Williams talking about the review he is conducting for the Government into the teaching of early years and primary mathematics.

Feedback and evaluation of the day was excellent as illustrated by the comment below :

> *I attended the conference in Birmingham and it 'did what it said on the tin'! Lots of teachers were talking about Maths! It's great to be given the opportunity to see what colleagues around the country are up to. The day confirmed my belief that we all live in hope - of that spark of real understanding from a child - will today be the day?* (Teacher)

As well as our national meetings, we are also increasing the number of our regional events. One approach is to use the expertise within the community to build networks of teachers, to support collaborative interactions and to work for their sustainability. Feedback from network meetings has again been excellent. One teacher wrote in to say:

> *The network meeting was fantastic, thank you very much. In fact, with a class last night I tried to get them to produce a series of questions for me and we had tremendous fun with it. I've obtained some great feedback and can honestly say it is one of the most inspiring lessons that I've ever had.* (Teacher)

The NCETM is also supporting the spread of networks whereby teachers take the lead in developing their own communities, thus not only spreading the ideas further, but also providing another and different type of CPD for the teacher-leaders, as described below:

> *The networks allow an up-to-date discussion of current issues in Mathematics, and include an opportunity to see and try something new. Regular team meetings at school focus on teaching and learning and I am then able to share the network content with other staff. Focusing on teaching and learning in this way has increased motivation amongst staff and encouraged them to 'try something new'. It has also allowed me the time to be imaginative and discuss, try and evaluate new ideas. It has also proved to be effective CPD for me as I am now much more confident and competent at planning and delivering more worthwhile teacher network meetings.* (Teacher)

Building a virtual community through the NCETM portal

As well as working with teachers directly, the NCETM is committed to extending its reach through its portal (see www.ncetm.org.uk). Figure 1 illustrates our model for a Professional Learning Framework for teachers that has driven the design of our portal.

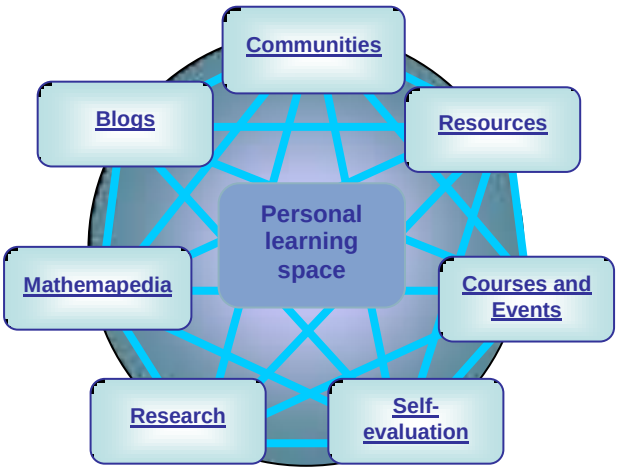

Figure 1: The NCETM's Professional Learning Framework

The labels around the outside of the circle represent different parts of the portal and these are described briefly in the next sections. Here I simply want to note that there has been a consistent upward trend in registrations on our NCETM portal reflecting in my view the increasing richness of its provision as well as growing awareness as to how it can be used effectively in schools, colleges and HEIs. At the time of writing (March 2008) 11 060 teachers

have registered, exceeding the target set us that was to achieve 10,000 registrations by March 2008. Moreover, in Jan 2008, the portal received nearly 31,000 unique visitors! It is impossible of course to know exactly the reason for increased usage, but we can cite face-to-face meetings, including with ITE institutions, the distribution of NCETM's monthly e-newsletter, which is becoming more and more popular, and an article incorporated into the DCSF e-newsletter that is sent to all schools.

I will now describe a subset of the innovative tools the NCETM has developed to support CPD for teachers of mathematics, taking examples from Key Stage 5 given the readership of this journal.

Self-evaluation tools

Self-evaluation tools are now on the portal that allow teachers, individually or in groups, to reflect on their current mathematical knowledge, understanding and skills. Teachers first select the strand in which they are interested: mathematics content knowledge or mathematics-specific pedagogy (embedding pedagogy in practice will be added later in the year). They then select the stage: early years, KS1, KS2, KS3, KS4, KS5 and adult learners, and then the topic that they wish to self-evaluate (see Figure 2 for a screen shot of this process).

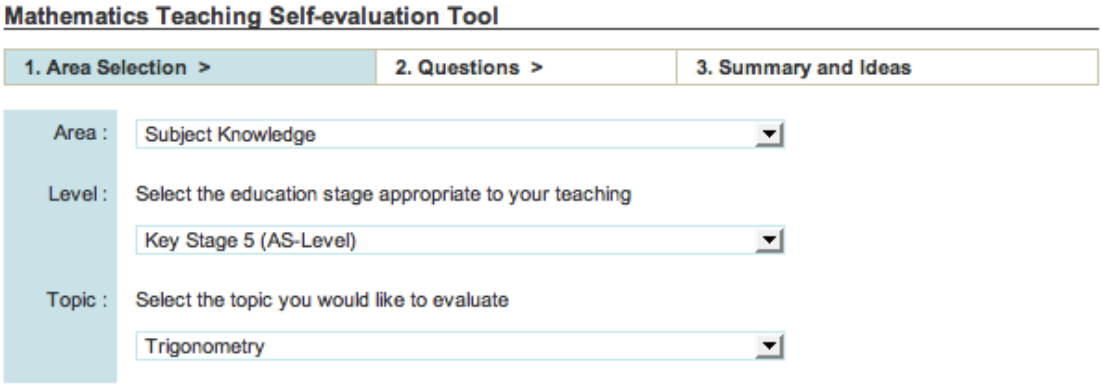

Figure 2: Choosing a mathematical topic to evaluate

Following this choice, teachers assess their level of confidence on a four point scale and are provided (if they wish) with an exemplar of the topic to assist in their self-evaluation (see Figure 3).

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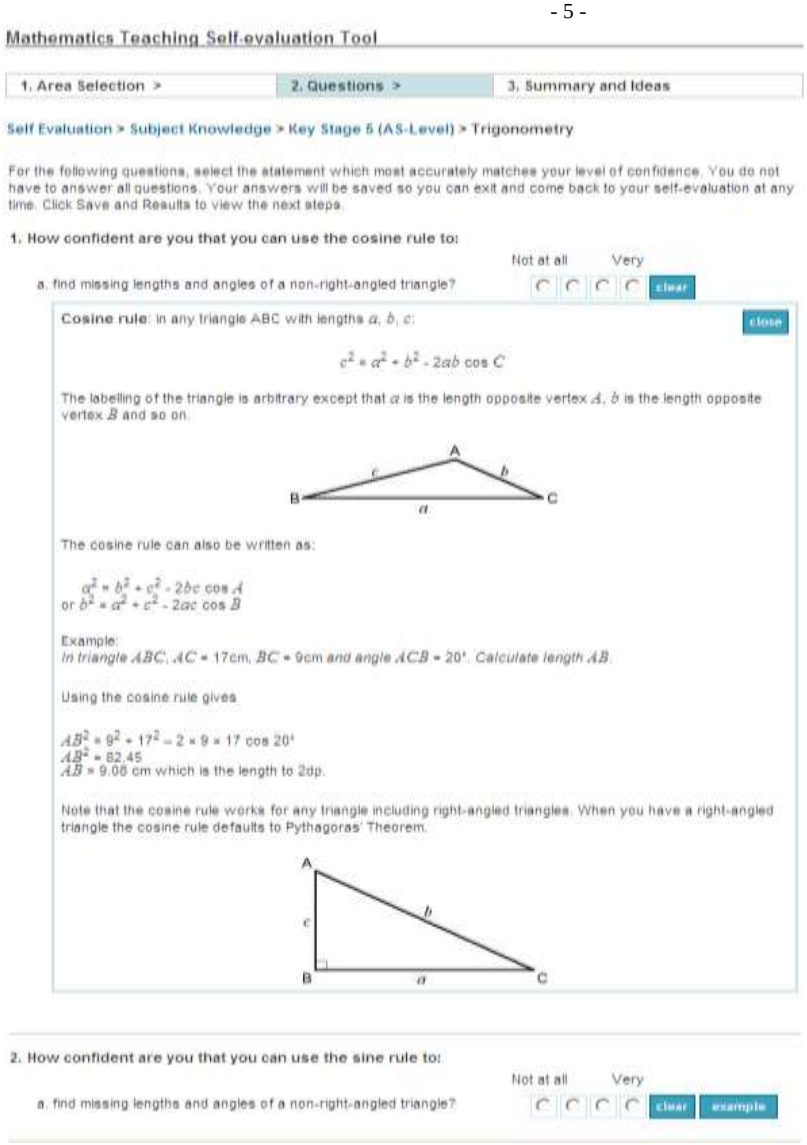

Figure 3: Assessing confidence in understanding the mathematics

The tool then produces a bar chart showing how confident the user is in the topics evaluated. Finally – and crucially -- the tool offers recommended next steps to develop practice and to support teachers in planning their own professional development.

To date our feedback on the use of the tool has been very positive as illustrated in the quotes below from a teacher:

> *The self-evaluation resources provide a facility for me to reflect on my own strengths and weaknesses, and we plan to use the materials as a team to evaluate the strengths and weaknesses in our mathematics department. This is useful in itself, but most importantly, the site provides the information on the courses and further reading that are most suited to developing the skills and plugging any gaps in subject knowledge. (Teacher)*

We have noted that the self-evaluation tools are increasingly being used as part of regular performance review in schools as described in the quotes from heads of mathematics and team leaders below:

> *The benefits in incorporating the tool into Performance Management were abundantly clear to the department as was its use in providing evidence-based support for internal and external CPD applications. (Head of Mathematics)*

> *Using the SET has been both an encouragement and an eye-opener for my colleagues in the Maths Dept and for me. The tool provides quick and valuable feedback by summarising self-measured confidence across the spectrum of skills within Mathematics, and the interface makes the whole data-gathering procedure very straightforward. (Head of Mathematics)*

We have held focus groups with HEI representatives to discuss the use of the tool in HEIs and its further development. It was seen as potentially valuable for example as a way for students to self-evaluate and be pointed to appropriate resources or to discuss the examples to see if these can be challenged or improved. As a result of these discussions we are actively seeking more examples; so do please send us content or better still get your students in groups to critique the tools and discuss what they see are better examples. Later in the year we will add the functionality for users to upload their own examples and hopefully view and discuss a range of examples added by other users.

Resources, Communities and Blogs

Resources are provided on the portal that link to materials that support CPD, some of which are offerred as 'next steps' following self-evaluation. Below is an example of feedback.

> *The resources section provides access to… case studies on the best approaches to teaching mathematics. Even as an experienced teacher these articles … ensure that I continue to reflect on my own teaching practice in a way that I have rarely done since being at university. They also ensure that I can provide support and professional development to the other teachers in my department.* (Teacher).

Communities and Blogs have been set up where teachers can share their ideas about teaching, professional development and current issues, and read what other teachers have to say. The comments below by teachers capture some of the enthusiasm generated in their use:

> *If you have not yet joined the NCETM community (if only to stop by the maths café for a chat or rant), you are missing a wealth of professional development opportunities and resources*.(Teacher)

> *I find the communities really useful for posting questions to other teachers: anything from an A Level question that isn't clear, to thoughts about the latest initiatives in education. I can guarantee replies not just from teachers but also from educational professionals or a member of the NCETM team.* (Teacher)

The NCETM needs more input and would welcome links to resources developed in HEIs, that have a CPD component, maybe, for example, a network of teachers who could discuss how the materials are used with learners, and could suggest next steps or alternative approaches.

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Research and the Mathemapedia

We have newly introduced a Research area on our portal in which we hope to gather together our own research findings, teacher research findings from the NCETM grant projects, and key research from the wider community. To meet our remit for CPD we plan to develop this area so that teachers are supported to use the materials for their own CPD or for CPD opportunities within schools and colleges.

The Mathemapedia is a wiki for mathematics education focusing particularly on mathematics pedagogy. As with the Research area this is currently under development and we need many new entries to be added. For the success of both of these areas we need to work closely with HEIs and would value discussions and contributions from across the community.

More generally, the power of our Professional Learning Framework will come into play when teachers can exploit all the links and interactions between its different elements – portrayed by the lines criss-crossing in the diagram in Figure 1. We have recently added to the portal a personal learning space for teachers including a link to the self-evaluation tools and a learning journal where reflections can be stored. This personal learning space will build up a picture of all interactions across the different areas of the portal. I am very much looking forward to exploring this innovative interactive framework with partners and investigating its use.

NCETM Grants

The NCETM is supporting teachers in developing their practice by funding classroom-based research, and then disseminating the findings through events and on the portal to inform the thinking of the wider community. The NCETM grants programme has to date awarded funds of £590k and supported 68 different projects. The grants have served to catalyse teachers to work on their own practice in collaborative groups and have achieved considerable success.

I pick out two to illustrate the rich diversity in the work:

i) Inspired by their involvement in the Standards Unit pilot of Improving Learning in Mathematics, four mathematics teachers from South Hunsley School, led by an AST wrote, developed and trialled a new scheme of learning at KS4 aimed at engaging and motivating lower achieving students. The scheme of work focused on active learning, encouraging active rather than passive participation by students. The mathematical ideas in the scheme were connected within themes and learnt in a memorable way to provide hooks to refer back to when it came to revision and problem solving. The impact of trialling this new scheme of work was a marked improvement in GCSE results, increased engagement and a successful ethos of peer-to-peer working in the mathematics department.

ii) St Edmunds Catholic School and Simon Langton Grammar School for Boys used their grant to investigate the impact on the attainment of students in mathematics of using the history of mathematics. The project revolved around the teaching of geometry, incorporating modern technologies such as Geometer's Sketchpad, all the while drawing upon the historical resources that show the development of geometry. One teacher commented that she didn't appreciate *"the depth there is in so many topics we have covered through this project. It has rekindled interest in mathematics in me; students find it interesting as well."*

Two more general comments about the scheme summarise for me its potential. First to give time to reflect together and feel part of a large teaching community:

> *The grant scheme has given myself and teachers in my department the opportunity to explore a section of Teaching and Learning that we otherwise would not have had the opportunity to do. The regular dialogue between the NCETM and ourselves has made us feel part of a 'group' as opposed to 'on our own'. The fact that we as teachers, get to sit and discuss mathematics, plan lessons together, and observe each other teach has been so beneficial, that it makes me glad that we went through the whole process.*

Second, and perhaps most crucially of all, the scheme shifts responsibility and ownership of CPD to the teachers themselves:

> *'The best thing about the grants scheme is it allows you to consider and research the issues and aspects which are of importance to you and your school and receive the funding and time to do it properly. Enabling me to do this has been educational and motivational to all those involved.'*

Most of the grants involve an HEI in some role to support, inspire or disseminate and we would like to encourage these sorts of constructive collaborative networks.

We are also extending the grant scheme to include a new strand entitled ‘Research into Practice’ grants. Through these grants we hope to work with HEIs to take research findings and develop these into materials for CPD that can be used in schools. This scheme will be available from April 2008 and we look forward to receiving applications for this.

Conclusion

There is still much to do and many challenges to face before CPD for all teachers of mathematics is recognised and demanded. Ultimately, the Centre will work to try to ensure that within a clearly articulated system of accountability and rewards, CPD for teachers of mathematics is an entitlement and a responsibility, and is recognised in appropriate career paths and accreditation. So 2008 will be important for the National Centre as we seek to engage more teachers and senior leaders in all sectors. We need to find more ways to work with our partners as we rely on them to help us to grow all the aspects of our provision. I hope the readers of this article will join us and make input, either yourselves, your colleagues, your students, or through any of the networks with whom you work. Come to our events, input to the portal, help us to engage with senior leaders. We rely on you all to help us to have the impact that we hope for and to really make a difference.

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