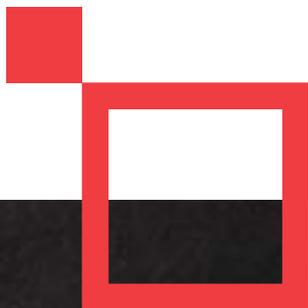


# Making Mathematics Count



$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

The Department for Education and Skills' response to  
Professor Adrian Smith's Inquiry into Post-14 Mathematics Education

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# Foreword



Mathematics is vital: it underpins research and development in the sciences, technology, and ICT; it is a key driver of economic and labour market growth; and it provides a set of key skills to enable individuals to reach their full potential in terms of life and work. Getting the teaching and learning of mathematics right is therefore a major education priority.

I want to thank Professor Adrian Smith and his team for their ground breaking Inquiry into Post-14 Mathematics Education. Their work, building upon the Roberts review published in 2002, has rightly put the spotlight on the future of mathematics education in the UK. *Making Mathematics Count* provides an excellent framework to determine our future strategy, which we explore in more detail in the proposals set out here.

I believe that the schedule of work proposed in this document presents an effective answer to the challenges ahead. Despite the good progress made through the Numeracy Strategy and the Key Stage 3 Strategy, there are still too few young people attaining the basic level of numeracy needed for everyday life, and developing the more detailed mathematical knowledge needed at AS/A level and beyond. I am committed to changing that.

However, I am realistic that this will not be an easy task. Revitalising the study of mathematics requires tackling issues of specialist teacher recruitment, training and development, as well as reforming the range and variety of learning pathways open to young people in mathematics. Achieving this will require the ongoing support and engagement of the wider mathematics community.

I look forward to working with you over the coming period to turn our shared vision for the future of mathematics into reality.

A handwritten signature in black ink, appearing to read 'Charles Clarke', written in a cursive style.

**Charles Clarke**



# Introduction

It is difficult to overstate the importance of mathematics in today's world, both for the individual and for the economy. The acquisition of mathematical skills is essential for successful progression in education and employment. At the same time a sufficient supply of mathematical skills is critical if we are to maintain our economic competitiveness. Mathematics clearly has interlinkages with science engineering and technology. To complement the strategy put forward in this document, the Government will therefore outline a ten-year investment framework for science and innovation<sup>1</sup>, to be published alongside the Spending Review 2004. Whilst mathematics provides a vital underpinning for the sciences, it is also important to a wide range of other disciplines. Indeed, as the UK moves increasingly towards a knowledge economy the need for mathematical skills at all levels, and in all employment sectors, will not diminish but grow.

However, despite the growing importance of mathematics in life and work, the number of young people choosing to continue to study mathematics after the end of compulsory schooling has declined steadily since 2000. The basic problem is that although more young people enter GCSE mathematics than any other subject (around 94% of the cohort) only about

1 A ten-year investment framework for science and innovation (HMT, DfES, DTI) July 2004

51% of these obtain grade C or better. This is well below the attainment level of many other subjects. Furthermore, only a small and declining proportion progress beyond GCSE. In fact the number of students continuing to A level is less than 15% of the number who achieve GCSE grade C or above, and of this 15% only about 10% go on to study mathematics at university. The implications of this declining trend are serious. Although the numbers of young people choosing to take mathematics at degree level have rallied in recent years we cannot be confident that this will be sustained in the face of falling A-level numbers. This in turn could adversely affect the supply of qualified mathematics teachers, exacerbating current shortages.

It is critically important that we meet this challenge purposefully and quickly. We intend to take action now to raise our young people's interest in mathematics and to improve the quality of teaching and learning. This document sets out our proposals for how we will achieve this and draws heavily on the analysis and recommendations of Professor Adrian Smith's Inquiry into Post-14 Mathematics Education. The proposals outlined here relate to the future of mathematics teaching and learning in England. The devolved administrations of Wales and Northern Ireland are considering the report's recommendations and developing appropriate solutions. The report did not make specific recommendations for Scotland but the Scottish Executive will take the analysis of policy and provision into account.

The strategy for mathematics education we put forward in this document strikes a fine balance. We recognise that in many senses mathematics has a unique status in our education system, and as a subject faces unique challenges. This calls for new measures designed to tackle these issues. However, we also need to ensure that our strategy builds upon what is already working well, both for mathematics education and more broadly, and utilises effective existing delivery mechanisms to maximum effect for the enhancement of teaching and learning in mathematics.

We have made good progress in providing the environment necessary for enhancing the learning experience up to and including Key Stage 3. The starting point for the National Numeracy Strategy was the poor performance of pupils in England in the international tests of 1995. Now achievement in mathematics at Key Stages 1, 2 and 3 is the highest it has ever been. The percentage of pupils achieving level 4+ at Key Stage 2 has risen by 14 percentage points since 1998, and the percentage of students achieving level 5 has gone up by 12 percentage points at both Key Stages 2 and 3 over the same period. We are clear that the Key Stage Strategies need to play a key role in further enhancing the teaching and learning of mathematics in schools.



# Key Findings

*Making Mathematics Count*, published in February this year, identified three critical areas of concern which are contributing to the declining trend in take up of, and achievement in, mathematics post-16. These are the supply of specialist mathematics teachers, the infrastructure required to support mathematics teachers effectively, particularly in terms of their continuing professional development, and the capacity within the current curriculum, assessment and qualifications framework to meet the needs of all learners.

## Teacher Supply

Professor Smith acknowledged in his report that we have made real progress in attracting increasing numbers to the teaching profession, but stressed that there still remain shortages in certain key subjects including mathematics. Shortages in the supply of suitably qualified mathematics teachers in secondary schools are likely to be made more challenging in the future by three key factors:

- the high percentage of mathematics teachers approaching retirement age;

- the relatively small proportion of students continuing to study mathematics at university; and
- the intense competition in the labour market for young people with high level skills in mathematics.

This combination of factors means that we need to act now to address current and future supply needs. Our strategy needs to build upon those measures which have already proved effective in attracting more graduates to the teaching profession, and must explore the full range of options for delivering effective mathematics teaching and learning. This includes:

- broadening potential routes into teaching;
- better use of ICT to support learning; and
- effective deployment of skilled support staff and other adults, including from higher education.



## Teacher Support and Continuing Professional Development

*Making Mathematics Count* was clear that we need to enhance the support available for existing teachers of mathematics to ensure that they are able to reach their full potential.

- Our five year strategy published later this year will set out a vision for a comprehensive framework for continuing professional development for all teachers.
- This will complement the emphasis currently placed on teacher development through the National Strategies.
- Building on this foundation we will provide an additional impetus for CPD in mathematics, focusing in particular on developing teachers' subject knowledge and subject specific pedagogy.

## Curriculum, Assessment and Qualifications

Professor Smith argued clearly that we will only attract more young people to the study of mathematics when we are confident that the curriculum and assessment framework can support a sufficiently wide variety of pathways to cater for the needs of all learners. We will:

- address immediately concerns that the current structure of the three-tier GCSE and Curriculum 2000 AS/A levels may be discouraging, or in some cases preventing, young people from continuing their study of mathematics post-16;

- longer term, secure the engagement of all learners through increased pathways, better vocational options, and stretching curricula for the most able. This will be integrated with our approach to broader curriculum reform to ensure consistency and portability of skills across the whole 14-19 curriculum.



# Strategic leadership and raising the profile of mathematics

The long term future of mathematics in the UK will depend on aligning action on the three critical issues explored above: teacher supply; teacher support; and curriculum development. To achieve synergy and consistency across these three areas, as well as reinforce the importance of mathematics as a discipline and a subject with young people, it is necessary to establish firm strategic leadership and to raise the profile of mathematics on a national basis.

*Making Mathematics Count* advocated the creation of a high level post within the Department to oversee the implementation of the mathematics strategy on a cross phase basis, as well as raise the profile of the subject both internally and externally.

We have:

- advertised for the appointment of a Chief Adviser for Mathematics;

- asked Anita Straker, from CfBT, who led the introduction of both the Numeracy Strategy and the Key Stage 3 Strategy, to work with the Department to help us develop our strategy until the permanent appointment can be made.

These measures are already giving the development of mathematics teaching the fresh and timely impetus it deserves.

We also recognise the need, identified in Professor Smith's report, for the mathematics community as a whole to be able to speak with a single voice about the development of the subject and its pedagogy.

- We recognise the valuable contribution already made by the Advisory Committee for Mathematics Education (ACME) and are keen that they should be able to play an enhanced role in the future.
- We also welcome the proposal put forward by the Council for the Mathematical Sciences (CMS) to provide the nucleus of an advisory committee to represent wider strategic issues on the role of mathematics in society and the economy.
- We have therefore asked Anita Straker, as the interim Chief Adviser for Mathematics, to begin exploring with the Chairs of both ACME and CMS the appropriate structures and mechanisms that will support these developments.

*Making Mathematics Count* also recommended the establishment of a National Centre for Excellence in the Teaching of Mathematics to provide a strategic leadership role and, alongside ACME, draw together the wider mathematics community.

- We will invite tenders, by March 2005, for the establishment of the National Centre.

The role and function of the National Centre is explored in more detail later in this booklet.

In parallel, early and important work is underway to raise the profile of mathematics directly with young people in schools and colleges, targeted particularly at encouraging the take up of mathematics in post-compulsory education.

- We have embarked upon a communications strategy for 2004 and 2005 to ensure young people are more aware of the usefulness of mathematics skills for future career and financial prospects.

All this work is of course underpinned by the continued and intensified use of existing policies and mechanisms to promote mathematics further. The Specialist Schools programme has a proven track record in raising standards of achievement and strengthening the quality of teaching and learning in secondary schools. It is a major advocate for subject expertise and is making a considerable contribution to the furtherance of mathematics in schools.

- There are currently 76 mathematics and computing specialist colleges, a number expected to increase to over 130 from September 2004.
- Mathematics is one of the fastest growing specialisms within the specialist schools network.

Furthermore we are continuing to use the National Strategies as the primary vehicle to drive attainment, motivation and engagement in mathematics from the age of 3 to 14 across all schools. As well as the provision of widely adopted guidance, training and support materials, the National Strategies:

- deploy an experienced field force of specialist mathematics consultants working alongside several thousand teachers in schools;
- provide curriculum development expertise and coaching in subject specific pedagogies and have been key to beginning the transformation of the way mathematics is taught in many classrooms.

In addition, the Department is supporting a wide range of specific programmes designed to raise the profile of mathematics and help both adults and children to develop the mathematics skills they need. These include, amongst others, "Count On", which has been extended and funded up to 2005, Mathematics in Education and Industry, United Kingdom Mathematics Trust Maths Challenges, CensusAtSchool, and the Millennium Mathematics Project.

**The Millennium Mathematics Project supports mathematics education and promotes the development of mathematical skills and understanding through enrichment and extension activities beyond the school curriculum. The project provides:**

- **web based teaching resources for 5 to 18 year olds (available free to schools) and produces careers information for older students;**
- **video conferencing facilities where classes can engage with local or international schools and subject experts.**

Through Success for All, the Department's Standards Unit has also embarked on a challenging programme to improve teaching and learning in mathematics in the post-16 learning and skills sector.

- There will be innovative teaching and learning resources and associated teacher training designed to engage and stimulate learners which will be available nationally in 2005.
- We will aim to improve learner success rates and make further improvements in inspection grades in post-16 mathematics.

All these activities provide us with a firm foundation for the development of the proposals set out in the following pages.



# The Supply of Mathematics Teachers

The problem of supplying trained teachers of mathematics in numbers large enough to meet all schools' needs has challenged governments for decades. Whether more or fewer new teachers have been coming forward overall, it is a problem that has at no time completely been solved. That is why, despite the boom in overall teacher numbers that the last five years have brought, any secondary headteacher will tell you that filling a mathematics vacancy with a high-quality recruit can be very difficult.

While we have started to improve the supply of qualified mathematics teachers, there is a considerable way still to go. This Government inherited trends of falling teacher numbers coupled with falling recruitment to teacher training. Both have been decisively reversed.

- In 1998, we introduced the Graduate Teacher Programme to give mature career-changers a school-based pathway into teaching.

- We have increased the total number of places on this programme every year since and it currently stands at over 5,000 a year.
- Around 10 per cent of all recruits to the programme are mathematics graduates.
- In 2000, we created £6,000 training bursaries and £4,000 Golden Hellos to bring more graduates into teaching in both schools and colleges through more conventional training routes. These have led to year-on-year increases in trainee numbers, with the largest rises coming in priority subjects like mathematics.
- This year, over 2,250 mathematics graduates have trained as teachers in England alone. That is more than in any year ever, twice as many as in 1997 and almost three times as many as in 1990.
- The number of unfilled vacancies for mathematics teachers in schools has fallen for the third year in a row.
- Mathematics graduates are applying for training courses starting next year in record numbers.

## **BUT**

- **We need many more qualified mathematics teachers to come forward to create a bigger and better quality pool from which schools can recruit.**
- **The school vacancy position in mathematics remains higher than for any other subject (270).**

This is why despite recent improvements in the supply of mathematics teachers we know there is still a big job to do.

In planning the next steps, we asked Professor Smith and his team to help us understand the market for mathematics teachers better. The conclusions they reached show that action is needed in five main areas.

## Finding out more about mathematics teachers

The Inquiry noted that we know relatively little about the characteristics of mathematics teachers and, in particular, of what qualifications they hold. In the past, our understanding of this key question has been based on an irregular survey of a small sample of secondary schools. The Inquiry felt that we needed a more complete understanding of exactly who is teaching mathematics in our schools and colleges as a basis for policy making. We agree.

At the same time we are conscious of how important it is not to burden headteachers with more requests for information. The creation of the Adult Common Basic Data Set will give us a chance both to reduce and rationalise the information we request from schools and Local Education Authorities (LEAs) and to collect a wide range of key data in real time. This will, within the next two years, allow us to create a School Workforce Database giving, for the first time, a really rounded picture of who is working in our schools and what they are doing.

- We will therefore ensure that the School Workforce Database makes available the key information that the Inquiry called for on the subject qualifications of the teachers and other school staff involved in teaching and coordinating mathematics.
- We will also complete a rapid research exercise about the mathematics workforce in the learning and skills sector to fill information gaps and help us to understand better why and when mathematics teachers join and leave the sector. We expect to have an initial report on this by March 2005.
- We will use the results of this work to feed into further improvements in recruitment and retention initiatives for the sector, in continuing professional development in post-16 teaching and learning, and in Further Education (FE) Initial Teacher Training (ITT).



The Inquiry also called for more research on how school leaders deploy staff to teach mathematics. The results of this research would not only inform central Government and LEA-level manpower planning, but could also serve as a source of good practice and ideas for individual school managers.

- We will therefore commission a comprehensive research project to survey and report on schools' staff deployment practices in delivering the mathematics curriculum.

## Recruiting more mathematics teachers

Despite recruitment successes of recent years, more still needs to be done to bring more mathematics graduates into teaching. Over a quarter of all teachers will retire during the next decade. We know already that the new staff who are being recruited to replace them hold higher academic qualifications than any previous generation of teachers. Her Majesty's Chief Inspector of Schools has confirmed that they are also being trained to a higher standard than any earlier intake.

We therefore need to maximise the number of new teachers we bring into the classroom, targeting our efforts on the areas where need is most urgent. To this end we will:

- raise the value of the teacher training bursary for mathematics in schools and colleges from £6,000 to £7,000 from September 2005;
- work with the Teacher Training Agency (TTA) to increase the proportion of Graduate Teacher Programme places taken up by mathematics graduate career-changers; and

- roll out nationally the subject-knowledge enhancement courses, that the TTA has been piloting successfully this year, for prospective trainee teachers of mathematics who do not have a mathematics degree.

Building on the successes of the past few years, and implementing these measures and the others announced in this booklet, we believe we can:

- eliminate as far as possible the undershooting of the national schools Initial Teacher Training targets for mathematics by 2007/8

## Retaining more mathematics teachers

The challenge is not simply to recruit more new teachers, but also to increase the proportion who take up careers in teaching and to retain more of the best teachers in the classroom for longer.

The proportion of trainee teachers who complete their courses successfully and go on to become teachers is rising. We want that to continue. The Golden Hello incentives, which have been encouraging newly-qualified mathematics teachers to take up jobs in maintained schools and complete their induction year since 2000, have proved their effectiveness.

- We will therefore increase the value of the Golden Hello for new mathematics teachers in schools and colleges from £4,000 to £5,000 for trainees entering PGCE and equivalent courses from September 2005 onwards.

In addition Professor Smith expressed particular concern that many of the best mathematics teachers move out of the classroom and into school management positions. We believe that, in many respects, a good school management team, delivering effective leadership is the most important factor in creating a positive learning environment.

We would not want to discourage any teacher with the ability to do so from taking up a leadership role. But we do agree that mathematics teachers of proven effectiveness in the classroom should not be penalised financially if they decide to stay in a hands-on teaching role. The contribution of such teachers makes itself felt not only among the students they teach themselves, but also among the professional colleagues who can learn from and be inspired by their example.

In recent years we have deregulated recruitment and retention allowances, so that schools have more flexibility to attract and retain the right staff. And we are reforming the pay and allowances structure in ways that incentivise the best classroom practitioners to do what they love – teach.

The development of Excellent Teacher Status over the next year will be another important step in this direction, giving our top teachers access to salaries over £35,000.

However, we believe even further measures are needed:

- The Advanced Skills Teacher (AST) grade offers a way for the best teachers to earn high salaries without leaving the classroom and we want more mathematics teachers to become ASTs in both secondary and primary schools.

- Subject to the statutory advice of the School Teachers’ Review Body, we therefore propose to remove the cap on pay for mathematics ASTs and to guarantee them a minimum salary of £40,000.

## Remodelling the workforce

There are currently over 132,000 teaching assistants working in the classroom and allowing qualified teachers to use their skills to best effect while keeping their workloads manageable.

Professor Smith recognised that the remodelling of the school workforce, within the framework of the National Agreement on Raising Standards and Tackling Workload, has exciting possibilities for mathematics. Schools have already made significant improvements in standards by developing new models of delivery which allow them to make full use of their high quality mathematic teachers. Examples of these include:

- flexible groups of pupils supported by trained teaching assistants and ICT, and directed by a fully qualified assigned teacher; and
- “input” sessions led by a teacher that are then consolidated by trained teaching assistants working with small groups.

We are working to support remodelling. Already, with the participation of the TTA, a pilot intake of generalist Higher Level Teaching Assistants (HLTAs) is being trained to national standards. They will be able to provide significant professional support to teachers in delivering the curriculum, especially at

Key Stage 3. We now propose to move further and make full use of the specialist qualifications and subject-knowledge that many HLTAs hold.

- We will recruit, train and support, through ongoing CPD, a new cadre of mathematics-specialist HLTAs to enable every secondary school in England to recruit at least one by 2007/8

We also want to explore new certification options for serving teachers. The TTA's new remit, which was announced on 29 March, will include continuing professional development for serving teachers alongside initial teacher training, support staff training and refresher training for returners to teaching. We will:

- ask the Agency, to work with others including ACME, to produce proposals for providing and accrediting training in mathematics for those, like teachers qualified in other specialisms, without conventional backgrounds in the subject; and
- explore ways in which mathematics staff working in universities could also play a role in supporting mathematics directly in schools.

## Bringing more undergraduates into schools

The Inquiry acknowledged the effectiveness of the Student Associates Scheme (SAS), which encourages good-quality undergraduates to consider training as teachers by giving them experience of working in schools as volunteers.

- There are over 5,000 student placements this year.
- Currently, 20% of all student associates are studying mathematics and mathematics-related subjects.
- For the Aimhigher strand of the Scheme, the figure is around 70 per cent.

We are committed to expanding the Student Associates Scheme. Even where participants do not intend to follow teaching careers, they can still be good role-models for pupils and a useful resource for school staff. This is especially true in subjects like mathematics, which students can often wrongly perceive as being dry. The enthusiasm of the undergraduate volunteers for their subjects can counteract this and have a really positive impact on students' subject-choices. We will therefore:

- offer 10,000 places to higher education students, a high proportion of which will be in the shortage subjects, by 2005/06; and
- expand substantially the number of undergraduate volunteers supporting students learning mathematics, by 2006/07.

# Supporting teachers' continuing professional development

*Making Mathematics Count* and the ACME report, *Continuing Professional Development for Teachers of Mathematics*, argue that it is essential for teachers of mathematics to pursue professional development throughout their careers, deepening subject knowledge, extending their subject specific pedagogy, and inspiring their pupils with the power and potential of mathematics.

For all teachers, at every stage of their career, there are three aspects of continuing professional development (CPD):

- developing a depth of personal subject knowledge to underpin teaching and learning;
- enhancing their repertoire of subject specific teaching methods and pedagogy; and
- applying general strategies for teaching and learning.

All three aspects contribute to all subjects but the need for them varies across disciplines. Research has shown that for mathematics in particular the subject specific elements are

critical in raising levels of pupils’ interest and attainment. They need to be pursued and supported through a range of strategies for professional development, including through practical application and effective coaching in the classroom.

## Context

The Department will shortly be publishing a new five year strategy. This will incorporate a vision for a mainstreamed and strengthened professional development framework for teachers, supported by rigorous new teaching and learning reviews which will ensure teachers are:

- focused on high quality classroom practice, using assessment for learning effectively as well as an appropriate range of teaching styles and strategies to promote personalised learning;
- constantly developing their professional expertise including, as appropriate, through sustained programmes of CPD;
- getting the CPD that matches the needs identified by the reviews and also offering coaching and mentoring to other teachers where they have pedagogic and subject skills from which other teachers can benefit; and
- paid, and make progress in their careers, in ways that fairly reflect their classroom expertise and commitment to their continuing professional development.

Through these developments more teachers will be given opportunities to:

- acquire knowledge in subject content, subject specific pedagogy, and teaching and learning strategies.
- see these demonstrated in different contexts; and
- practise in their own classrooms and receive expert feedback and coaching.

This provides the basis for adding further professional development opportunities for teachers of mathematics. From their teaching and learning reviews mathematics teachers will identify their personal learning needs which will be addressed through a range of CPD options including twilight sessions, peer to peer support, modelling classroom practice from expert teachers, coaching and feedback in the classroom, off-site courses, and interactive study supported through ICT or Teachers TV.

We will build on the full range of existing mechanisms for delivering high quality CPD, including the National Strategies, the Specialist Schools networks, ASTs, LEAs and Higher Educational Institutions (HEIs). We will also work closely with the TTA in their new coordination role.

Building on our key programmes, we will:

- stimulate increased demand in mathematics teachers to undertake structured development which will extend and reinforce subject knowledge and pedagogy;

- increase the supply of high quality CPD provision to meet the needs of teachers of mathematics. This will involve:
  - establishing a National Centre for Excellence in the Teaching of Mathematics; and
  - building capacity at school level through sustainable local networks, each with a pool of mathematics expertise

Once the National Centre for Excellence in the Teaching of Mathematics is up and running it will be important that the networks have access to the National Centre’s expertise.



## Stimulating demand in mathematics teachers for structured professional development opportunities

We are committed to empowering more teachers of mathematics to take personal responsibility for their professional development and to seek out appropriate learning opportunities. We will therefore:

- remit the new National Centre for Excellence in the Teaching of Mathematics to develop a framework for mathematics CPD. This will identify broad learning outcomes appropriate to different career stages in primary and secondary schools and colleges, suggest corresponding development activities, and include provision for teachers to explore and articulate their individual needs;
- discuss with the profession the use of one INSET day for subject specific professional development, from 2007; and
- ensure that new proposals for school self evaluation and inspection, recently announced as part of the New Relationship with Schools, require schools to demonstrate a strong commitment to CPD, which promotes subject renewal as well as generic school improvement.

## National Centre for Excellence in the Teaching of Mathematics

We will establish a National Centre for Excellence in the Teaching of Mathematics to provide strategic direction and leadership and, with the support of ACME, draw together the wider mathematics community to contribute their expertise. In doing so the National Centre will work alongside the TTA, in its new role for subject specific professional development, and the National Primary and Key Stage 3 Strategies to build capacity at school and college level.

- We will invite tenders against a detailed specification by March 2005, which will include the National Centre's role in respect of further and higher education and workplace learning.

In the short term we will remit the National Centre to:

- draw up, in consultation with the mathematics community and the National Strategies, the Mathematics Continuing Professional Development Framework, as described above, taking account of the wider CPD framework for all teachers;
- map existing provision onto the Framework and discuss with Ofsted its role in monitoring the provision;
- establish a searchable database of mathematics professional development provision and resources and, research and development findings;

- analyse the professional development needs of mathematics ASTs.

In the medium term, we envisage the National Centre will:

- analyse the need for further subject knowledge/pedagogy provision, including particularly the use of ICT in teaching mathematics, application of mathematics across the curriculum, and supported distance learning;
- support, broker, quality assure, and on occasions provide mathematics CPD;
- explore the potential for accrediting personalised programmes of mathematics professional development;
- foster independent mathematics initiatives, which can contribute to school mathematics networks; and
- stimulate links between universities and schools and with businesses and other organisations which are high users of mathematics.

### **Building capacity at school level through sustainable local networks**

Developing pools of mathematics expertise within schools, and deployed by schools, is a powerful way to increase the relevance, intensity and range of CPD opportunities on offer at a local level.

In primary schools we will:

- ensure that mathematics CPD opportunities focussing on mathematics subject knowledge and subject specific pedagogy are offered to schools and primary networks through the Primary Strategy consultants, LEA school improvement teams, and providers such as HEIs;
- within our new primary networks programme, develop central points of mathematics expertise, leading to the establishment of around 1500 – 2000 primary mathematics centres nationwide. This will complement the mathematics support schools will continue to receive through the Primary Strategy;
- reinforce the central points of mathematics expertise through the dedicated support of a mathematics AST, Leading Teacher or Consultant, and over time provide the necessary training and development to increase the supply of mathematics ASTs;
- revise and extend the range of written and interactive CPD materials to provide greater support for subject specialism. This will include providing mathematics-specific support for ASTs and leading mathematics teachers in the greater use of ICT to teach complex mathematical concepts, with support beginning to be available during this financial year;
- increase the impact of the Primary Leadership Programme on mathematics. We will involve Mathematics Coordinators alongside headteachers and make mathematics compulsory in the associated training programme for participating schools; and

- expand the opportunities for primary networks to develop links with subject experts in Specialist Schools, HEIs and sixth form colleges.

In secondary schools we will:

- extend mathematics CPD opportunities for teachers of post -14 mathematics in schools and colleges;
- develop a stronger network of mathematics ASTs, leading teachers, leading departments and consultants, supported by the Key Stage 3 Strategy.

These will be deployed through the mature pattern of networks and collaboratives already established between secondary schools. In particular they will support local action-research networks, as well as Specialist School, Leading Edge and Leadership Incentive Grant (LIG) collaboratives. We will:

- provide subject specific development and support for mathematics ASTs; and
- expand the opportunities for professional development through links with mathematicians in universities, sixth form colleges and industry and commerce. This will reinforce our expansion of the Student Associates Scheme detailed earlier in this booklet.

These measures will be developed in full partnership with the Specialist Schools Trust, the KS3 Strategy and the Standards Unit to complement and enhance their support for schools and FE colleges.

In the learning and skills sector, working with practitioners, we will introduce:

- nationally from September 2005, a challenging programme to improve teaching and learning in mathematics and related curriculum areas in colleges and other post-16 providers; and
- innovative multi-media teaching and learning resources, designed to engage and stimulate learners, and associated continuing professional development, designed to provide post-16 mathematics teachers with opportunities to engage with interactive teaching techniques.

For an individual teacher these proposals will translate into a menu of options, available locally, which will provide a strengthened focus on mathematics specific continuing professional development, new tools and resources, and greater access to mathematics expertise in schools, HEIs and the wider community.



# Curriculum Pathways, Assessment and Qualifications

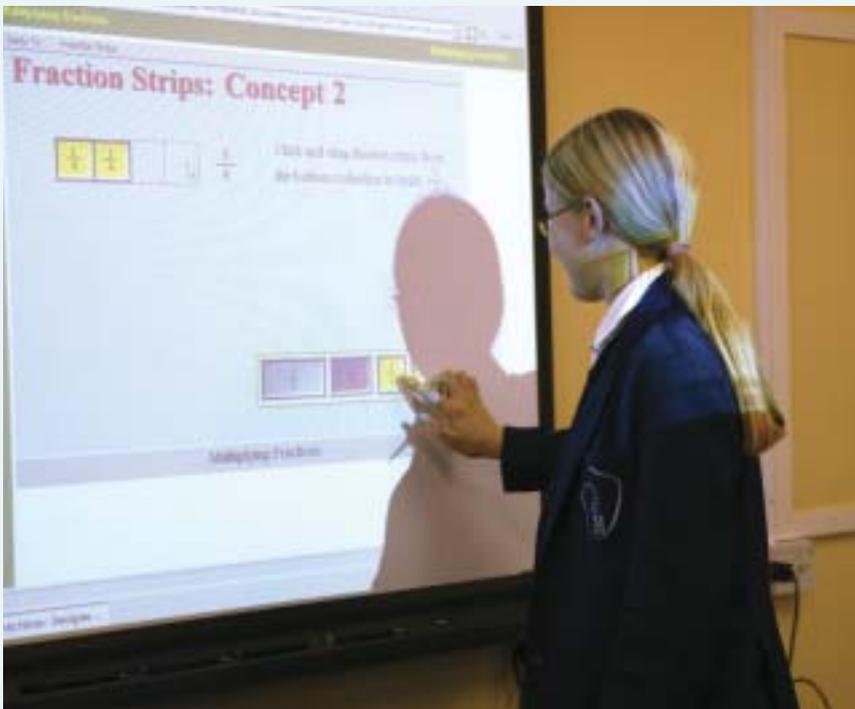
We are clear that if we are to find ways of interesting more young people in mathematics and increasing the numbers that progress beyond GCSE, we must ensure that we have a curriculum, assessment and qualifications framework that responds to the needs of every learner and allows them to fulfil their potential.

In this section we set out a number of proposals for achieving this. It is critical that these are taken forward within a coherent framework that supports the longer term reform of 14-19 education. We will therefore judge all proposals for taking forward reform of the mathematics curriculum and qualifications framework against the four key principles that underpin the broader 14-19 agenda. These are:

- **excellence** – do they stretch the most able?
- **vocational** – do they address the historic failure to provide a high quality vocational offer that stretches young people and prepares them for work?

- **assessment** – do they reduce the burden of assessment?
- **engagement** – will they counter the scandal of high drop out rates?

We are also aware of the need to minimise any potential adverse impact on schools, colleges and awarding bodies of seeking to introduce changes at short intervals and not allowing sufficient time for them to bed down. We have therefore asked the Qualifications and Curriculum Authority (QCA) and the Working Group for 14-19 Reform to take forward specific tasks, with a view to most of their outcomes informing longer term reform. Nonetheless, where feasible and where we have judged that these will make a significant difference, we want to make changes at the earliest opportunity.



## GCSE

At GCSE we agree with the underlying argument in Professor Smith's report that all learners should have access to grade C – a pass at level 2 – and all those obtaining grade B should be tested on higher level material. This will maximise the opportunity for every learner to progress beyond a level two qualification if they have the aptitude and the ability to do so.

- We will take a firm decision on the introduction of a two-tier mathematics GCSE this Autumn once we have the evaluation of the two-tier pilot following this Summer's exams.
- If the evaluation is positive a two-tier GCSE in mathematics could be taught nationwide from September 2006.
- In parallel we have asked QCA to develop guidance for an extension curriculum separately at KS3 and KS4 recognising that student engagement will be key. This can be piloted from January 2005 with a view to being made available nationwide from September 2006, and will complement ongoing work in the department to develop and better publicise the bank of optional teacher assessment tasks in maths for gifted and talented pupils at KS1-3.

In terms of the longer term development of the curriculum and qualifications at Key Stage 4 we have asked the QCA to:

- review the statistics and data handling content of GCSE to determine what should be retained as part of the core curriculum for mathematics and what may be beneficially seeded for delivery through other subjects, particularly science. They will also consider potential flexibility that unitisation of all GCSEs may offer;
- feed the outcomes from this work and that on unitisation into their development of the GCSE curriculum, with a view to getting the weighting of mathematics right for longer term reform of 14-19 provision;
- examine how ICT may be used more effectively in delivery of mathematics learning and how learners may be better enabled to harness ICT and mathematics skills. We expect the QCA will take account of developments on the Department's ICT Strategy and make use of external experts such as Becta.

## GCE AS and A level

Beyond GCSE we remain concerned about the falling numbers of students opting to take GCE AS and A level Mathematics. The review of AS Mathematics by the regulatory authorities following the introduction of the Curriculum 2000 reforms identified that the content of the AS specification was too great to be taught and mastered in the first year of study. Action is underway to address this.

- The criteria have been revised with core content being redistributed over four rather than three units and the number of applied units reduced to two.
- The new 4:2 model will be available for teaching from this September.

We are confident that by making the volume of the qualifications more manageable greater numbers of students will be encouraged to take up mathematics at level 3 and beyond.

In parallel we intend to take further short term measures to increase the number of students opting to continue their study of mathematics at AS and A level.

- The marketing campaign outlined above will encourage more students with GCSE grade C or better to progress to GCE AS or A level Mathematics, Further Mathematics and Advanced Extension Awards (AEAs).
- To encourage increased take-up of Further Mathematics, we will also develop proposals to replicate and expand the current Mathematics in Education and Industry Project with a view to establishing a Further Mathematics centre in each of the 47 local LSC areas.

We also realise the need to understand better the factors that influence students subject choices at AS and A level, and have asked the QCA to undertake two pieces of immediate research to shed light on this issue:

- from September 2004, to analyse the patterns of young people studying but not taking GCE Mathematics. This will provide insights for the development of longer term provision; and
- to investigate current practice in schools and colleges that attract large numbers of Further Mathematics and AEA candidates with a view to preparing good practice guidance, for instance on curriculum organisation, for dissemination in early 2005.

In terms of medium to longer term development at GCE AS and A level we are considering the scope for HEIs to influence this agenda positively. This may involve:

- taking further steps to promote mathematics and encourage young people to take GCE;
- incentivising students to apply for mathematics courses; and
- providing opportunities for students directly to take up mathematics in higher education.

## Other Qualifications

In addition to GCSE and GCE AS and A level, there is a range of other qualifications which have a critical role to play in promoting continued study and increased attainment in mathematics for all learners. We believe it is important that weightings ascribed to different qualifications are correct, clear transparent and widely disseminated so that students, employers and the educational sector can have confidence in the rigour and appropriateness of awards.

- We have asked the QCA to review comparative weightings ascribed to current qualifications especially GCSE mathematics, key skill Application of Number and the Free Standing Mathematics Qualifications and to provide advice on the way forward by Spring next year.

## 14–19 Reform

Finally it is critical that all these proposals dovetail with the future of the 14-19 curriculum currently under development. Professor Smith's report set out some key principles for the construction of future pathways for mathematics provision and suggested several potential models. We broadly support these principles and are looking to see how they can feed into the ongoing work of the Working Group for 14-19 Reform.

**We are expecting the final report of the Working Group for 14-19 Reform, to be published in the Autumn, to set out a proposed model for delivery of mathematics within a diploma framework. This will reflect the need for all learners to acquire a core of essential mathematical skills and to have opportunities to extend their learning to meet their particular aspirations. The report is also expected to point to the need for further detailed modelling and curriculum development work and to make recommendations for an implementation timetable.**

In developing the model, we expect the Working Group will draw on recommendations in Professor Smith's report.

They will also consider and make recommendations for:

- across-the-board reductions in the volume of coursework at foundation and intermediate level; and
- revised assessment styles and volumes at advanced and other levels which will be reflected in the design for mathematics provision at these levels.

In parallel the QCA, working together with ACME in an advisory capacity, will lead on commissioning and co-ordinating some of the more detailed modelling and curriculum work.

We recognise that there are difficult and complex issues that need to be resolved if we are to develop a successful model for mathematics provision that takes into account the unique characteristics of the discipline but is compatible with the design for the overall diploma framework. We will be looking to the QCA to take forward this work with help, advice and support of the wider mathematics community as well as ACME.

# Conclusion

We feel confident that these proposals provide an exciting and dynamic approach to developing the future of mathematics in this country, and we wish to thank Professor Smith and colleagues for their critical analysis and ongoing support which have helped us get this far.

The mathematics strategy, as outlined in these pages, sets out a mixture of work which is already underway, work that has been planned and for which timescales and expectations have been set, and areas where we believe further research is needed. This approach gives us the flexibility to be able to respond to new challenges as they arise, whilst ensuring that we can start work immediately to address some of the most critical issues.

The success or failure of these proposals will depend on the extent to which all stakeholders, both inside and outside the education system, are able to work together towards a shared vision of the future of mathematics in England. *Making Mathematics Count* provided the vision behind which all can unite, and the actions outlined here take us one step closer to that.



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