Response from ATM and MA

Department for Education

Consultation Response Form

Consultation closing date: 16 April 2013
Your comments must reach us by that date.

Reform of the National Curriculum in England:

Consultation Response Form

Response from ATM and MA

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Please tick if you want us to keep your response confidential:	
Reason for confidentiality:	
Name: Tony Cotton (ATM Hon Sec), Adam McBride (MA chair of council)	
Organisation (if applicable): **Association of Teachers of Mathematics (ATM) and Mathematical Association (MA)**	
Address: Association of Teachers of Mathematics, Unit 7 Prime Industrial Park, Shaftesbury Street, Derby, DE23 8YB Email: tonycotton@atm.org.uk Mathematical Association, 259 London Road, Leicester LE2 3BE Email: a.c.mcbride@strath.ac.uk	

If your enquiry is related to the DfE e-consultation website or the consultation process in general, you can contact the Public Communications Unit by e-mail:

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consultation.unit@education.gsi.gov.uk or by telephone: 0370 000 2288 or via the Department's 'Contact Us' page.

Please indicate one category that best describes you as a respondent

	Primary School		Secondary School		Special School
	Organisation representing school teachers	YES	Subject Association		Parent
	Young Person		Higher Education		Further Education
	Academy		Employer/Business Sector		Local Authority
	Teacher		Other		

Please Specify:

This response has been compiled by members of the Association of Teachers of Mathematics (ATM) and the Mathematical Association (MA) including the 65 members of the Joint Association of Teachers of Mathematics (ATM) and Mathematical Association (MA) Primary Expert Group and has been approved by the councils of both associations.

The ATM and the MA are professional associations with a long history of working with teachers - not as trades unions but as the agents for curriculum and professional development. Their role has been acknowledged and respected by governments for over a century. ATM's guiding principles state that, 'the ability to operate mathematically is an aspect of human functioning which is as universal as language itself' and the MA 'exists to support and enhance mathematics and the teaching and learning of mathematics and its applications'. The associations believe that all learners should have access to high quality teaching and the opportunity to succeed as highly as possible.

Association members are drawn from across the education community including practising teachers at all levels of education, university lecturers, freelance consultants and employees of national mathematics bodies.

The mathematics subject associations would welcome the opportunity to meet with Government representatives, read and respond to any proposals, and offer suggestions for how the ATM and the MA could support the DfE to develop and implement ideas.

Members are concerned that many authoritative and widely accepted reports – and much high quality research by teachers and academics – into mathematics education

have been published over the past 30 years, the findings of which have been largely ignored in the preparation of this draft Programme of Study. We would really welcome the chance to redress the balance and draw on this bank of knowledge and expertise to influence the content and feel of the mathematics Programmes in of Study for England.

Crucially we have an overarching concern about the timescale for the wide ranging educational reform that is currently underway. We believe that children need to be able to follow the full programme of study before they are assessed and therefore the first KS2 assessments should be four years after the curriculum is introduced, i.e. in 2018, not 2016 as currently scheduled.

Are you answering this consultation in response to particular subjects? Please tick all those that apply.

	English	YES	mathematics		science
	art & design		citizenship		computing
	design & technology		geography		history
	languages		music		physical education
	Not applicable				

Response from ATM and MA

1 **Do you have any comments on the proposed aims for the National Curriculum as a whole as set out in the framework document?**

Comments:

These comments are about the aims for the whole curriculum as set out in paragraph 3.1

England needs a curriculum that enables all young children to become successful learners, confident individuals and responsible citizens able to thrive in and contribute to an economically vibrant future in a globalised technological society, particularly those who are disadvantaged.
It should be consistent with the legislation requirements , as set out in the Education Act of 2002, that the curriculum should:

- promote the spiritual, moral, cultural, mental and physical development of pupils at the school and of society, and
- prepare pupils at the school for the opportunities, responsibilities and experiences of later life.

It should be assessed in a way that encourages outstanding teaching and secures excellent progression and high attainment for all young people.

We commend the aim that children be introduced to core knowledge and the aspiration for an educated population. However, we question what it means to be educated. For example, as well as children being exposed to ideas from the past, we would also like to see some aims pertaining to how the curriculum supports pupils to develop, explore and create, and how it endeavours to instil a love of learning in pupils. An aim referring to preparing pupils for the 21st century and beyond would also be desirable.

We agree that teachers should have the freedom to develop 'exciting and stimulating lessons' based upon the curriculum and therefore the curriculum needs to be flexible enough to allow time for this to happen. Having time and expertise to make the curriculum 'exciting and stimulating' will be something we will come back to later in this response.

These comments are about the aims for the mathematics curriculum as set out on p53

For consistency, the aims of the National Curriculum need to be reflected in the aims for mathematics and these in turn need to be reflected in the programmes of study for mathematics.

As we read the aims for mathematics, we find ourselves wondering whether this is a curriculum that will have the desired outcome of greater take-up for mathematics qualifications post-16.

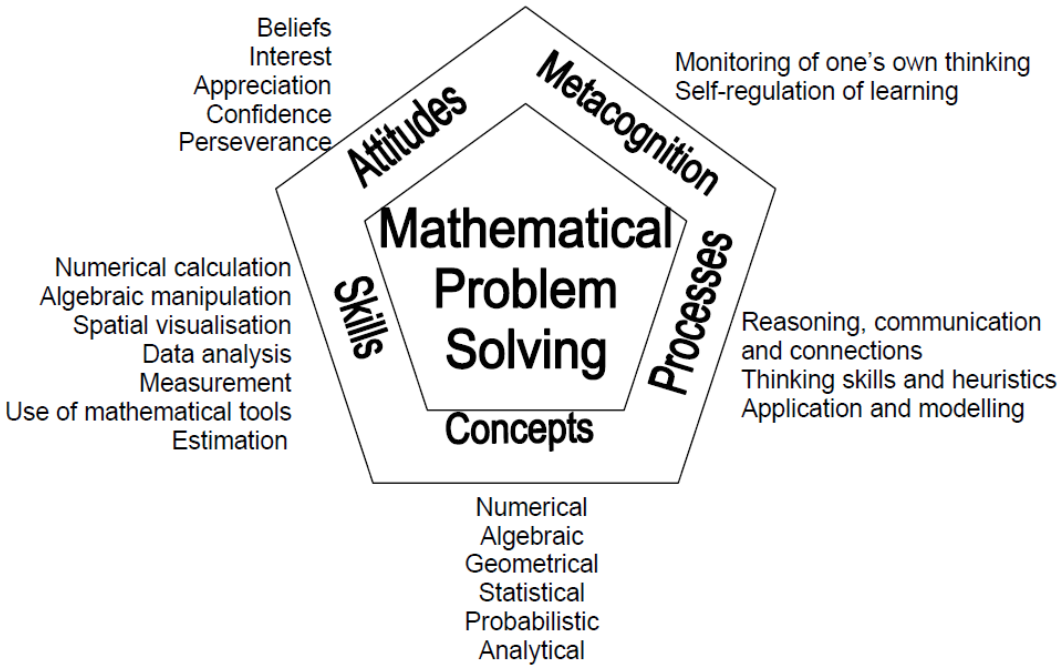
The **purpose of study** on p53 is good and we are particularly delighted to see the words 'enjoyment and curiosity' appear here, as developing good pupil attitudes to mathematics should be something that is at the heart of a new curriculum. Mathematics

must be seen as more than knowing facts and being competent with procedures. Work by Boaler (2009) and others (e.g. Dweck, 2000 and Brown et al., 2007) tells us the importance of positive attitudes among learners and the importance of pupils not being labelled as failures at a young age.

Anecdotally, members of both associations know of many parents who describe themselves as being 'rubbish at maths' and we recognise that these attitudes get passed on to children. We were pleased to hear Ms Truss MP make reference to this in her speech in January 2013. However, we are concerned that this curriculum will not address these concerns as even more learners are being set up to fail. The ability to use mathematics effectively is important at all skill-levels, not only for high attainers.

The aims for the mathematics curriculum are of paramount importance and we feel that it is essential to get these correct as they should set the scene for and be at the heart of the programmes of study.

As described in the purpose of study, mathematics is a 'highly inter-connected discipline', and we would like to recommend a diagram such as the one used by Singapore (see below) to set out the aims. Note that Singapore has problem solving at the heart of its successful curriculum. The advantage of a diagram such as this is that it suggests that all of the aims are of equal importance, and that they are connected and mutually reinforcing.



Stakeholders looking at this draft may reasonably perceive there to be a hierarchy in the order of the aims and the present text could be interpreted to suggest that securing

fluency and rapidity in simple arithmetic is of greater importance than the ability to approach problems by thinking and working like a mathematician. We suggest that in the 21st century, knowing facts and being able to perform procedures is of lesser importance because of the abundance of tools and knowledge that are so easily accessible on mobile phones and the internet.

With regards to international comparisons, Askew et al. (2010) argue that it is not actually clear what constitutes 'high performance' in mathematics; that differences between countries are not large and are often statistically insignificant; and that both TIMSS and PISA are just snapshot comparisons, as they lack longitudinal data of students' performance over time. Also, research by Andrews and Sayers into five European countries (Andrews, 2006; Andrews and Sayers, 2006a, 2006b, 2008) identified differing performances of countries over two tests.

With reference to England's actual performance in international tests, the OECD itself has argued that the 2000 and 2003 PISA results should not be used as comparators because England's response rate was too low (OECD, 2009). This would appear to contradict the myth that we have 'plummeted down the league tables from 8th to 27th'. Also, the actual TIMSS results contradict the 'stable' and 'falling' comments found in recent reports (Conservative party 2011: 7; DfE 2011: 37). In 2007, only the Pacific Rim countries performed significantly better than England, and the official NFER report states that 'England's performance at year 5 is amongst the best in the world and continues to improve' (NFER, 2008). This strong primary performance has been confirmed by Jerrim and Choi (2013).

What England's performance in international comparisons does suggest is that greater emphasis is needed on 'using and applying' mathematics (sometimes called mathematical literacy), since TIMSS tests technical and procedural competence whereas PISA tests students' ability to apply mathematics in context. Both the ATM and the MA believe that problem solving should be at the heart of mathematics learning, as it is in all high performing jurisdictions.

We are very pleased to see that developing pupils' ability to persevere is included in the aims and we feel that there is scope for this to be expanded to include more about attitudes to the subject. This would be in-line with other curricula (e.g. Singapore, New Zealand, Scotland) where a statement about learners' attitudes and dispositions is included in the aims.

The aim which currently sits first in the list has a number of confusing elements which we feel infer particular pedagogies. We feel especially uncomfortable with the phrases 'frequent practice' and 'rapid recall'. Both of these are likely to encourage rote learning at the expense of understanding. We believe that 'conceptual understanding' should be first in this aim so that it is understood that this comes before and is a pre-requisite for fluency. We draw your attention to the following from the Ofsted (2012) *Made to Measure* report:

> The responsibility of mathematics education is to enable all pupils to develop

> conceptual understanding of the mathematics they learn, its structures and relationships, and fluent recall of mathematical knowledge and skills to equip them to solve familiar problems as well as tackling creatively the more complex and unfamiliar ones that lie ahead. (ibid. 2013: 6)

To help with issues around the language used in the curriculum, we suggest that a mathematical glossary (as is provided for English) is included. This would help teachers to consistently interpret references to 'fluency' and 'conceptual understanding' (for example).

We note there are inconsistencies between the aims for mathematics as stated and the text in section 5.5 pertaining to numeracy and mathematics. We support the statement in 5.5 and believe that the overall aims for mathematics are missing any reference to developing resilience and awareness of mathematics as a human endeavour.

We suggest the following aims as an alternative:

The National Curriculum for Mathematics aims to ensure that all pupils:

- Develop their mathematical understanding through solving problems in familiar and unfamiliar contexts and modelling real-life scenarios
- Can reason mathematically by following a line of enquiry and develop and present a justification, argument or proof using mathematical language.
- Develop conceptual understanding alongside fluency and efficiency in mathematical techniques and procedures with mental methods as a first resort.
- Are confident, resilient learners of mathematics willing to persevere with challenges with flexibility, enthusiasm and curiosity

Despite having problem solving at the centre of their curriculum, educators in Singapore have recognised that this has not been realised in many classrooms and needs to be strengthened. They recognise the need for in-service professional development, with longer courses to develop deep conceptual understanding of problem solving, particularly to meet the needs of the 21st century (Leong et al., 2011). Teaching a method or algorithm and providing children with practice is relatively easy although recall tends to be poorer than when accompanied by understanding; the more challenging aspect of teaching is developing conceptual understanding through problem solving. We should learn from this.

Research shows that new mathematics can be learnt through problem solving and exploration and that in developing proficiency, fluency and problem solving are mutually dependent (e.g. Anthony and Walshaw, 2007). We think it is essential that the aims for the mathematics curriculum in England do not suggest otherwise.

If the aims for mathematics are not embedded and clearly visible in the programmes of study, there is a danger that they may be missed by teachers turning just to the expectations for their particular class. This means that only content will be taught but

less effectively earned and that opportunities to develop children's ability to think and work mathematically may be missed.

There are various options for how links to the aims might be made. Here are two suggestions:

- Opportunities/expectations for reasoning and problem solving could be made more explicit at the start of each section of the primary programme of study, as for KS3 and KS4
- Introduce a new section within the programmes of study entitled 'problem solving and reasoning' – in which detail is given for what should be taught during the year group in this aspect of mathematics. Of course, there is a chance that this will be ignored if it is not assessed, as happened to Using and Applying Mathematics in previous versions of the curriculum.

The text that accompanies the aims contains a useful section on spoken language, which is known to be crucial to children developing conceptual understanding. The statement on ICT is less helpful, failing to acknowledge the benefits of appropriate calculator use. There is a wealth of evidence that ICT can support the development of conceptual understanding and provide environments in which children can explore mathematics and solve problems. Note that calculators are one such tool and should be treated as such. Calculators are well known to support the development of 'number sense' (Williams and Thompson, 2003) and children enjoy developing mental skills in order to 'beat the calculator'. Furthermore they learn when to choose a calculator to solve a problem (Ruthven, 1998). In recent years the Key Stage 2 tests have incorporated a small number of items that require children to be able to make effective use of a calculator and we would recommend that this continues to be the case as effective calculator use is an important skill for modern society.

Response from ATM and MA

2 **Do you agree that instead of detailed subject-level aims we should free teachers to shape their own curriculum aims based on the content in the programmes of study?**

	Agree	✓	Disagree		Not sure

Comments:

It is preferable that all schools work with the same subject-level aims, if these have been carefully designed to reflect the overall curriculum aims and how the subject contributes to the realisation of these aims. If schools were just provided with a list of content to cover then this list would have to include specific elements of the skills of mathematical reasoning, representing and problem solving techniques. Without these, there would be a danger (as there is at the moment) that these do not get taught.

Schools would probably develop their aims for mathematics in line with their school ethos. Dependent upon the school personnel and their knowledge of mathematics specific pedagogies, this could and will lead to a very wide variation in the aims and the quality of teaching.

For example, we know that some schools will encourage an approach to mathematics teaching that is rich in problem solving opportunities and cross-curricular links, where parents and carers are involved in their children's learning. In these schools, teachers will become excited by teaching mathematics and a love of mathematics will be nurtured amongst the whole school community. We also know that others will be very different.

There will be a great many demands on schools to implement this new curriculum and the mathematics subject associations are concerned that in many schools there is simply not the expertise to develop a school curriculum. At primary, there are some very good mathematics specialists who will be well-equipped to lead their schools through change (many as a result of participation in the excellent MaST programme) however the majority of primary teachers are non-specialists, and will need more detailed guidance and professional development support to develop a school curriculum for mathematics. This problem is not confined to primary, many secondary schools do not have a department of fully qualified teachers and many KS3 lessons are taught by non-specialists. It is important that the guidance provided to all schools is clear and supportive.

As there are an increasing number of schools that do not need to follow the National Curriculum, we question the ease by which children can smoothly transfer between schools. Would it be possible for the aims of the individual subjects to apply to all schools but the detailed programmes of study to be only used by those state schools that are required to follow the National Curriculum?

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An alternative approach might be to provide schools with the aims only and for schools to decide the content, although all the caveats above would apply. On the other hand this may lead to a more skills-based rather than content-driven curriculum which in the long-run, with good teaching, could result in children being better prepared for the 21st century.

Response from ATM and MA

3 **Do you have any comments on the content set out in the draft programmes of study?**

Comments:

The draft programmes of study for mathematics are not fit for purpose and continue to be in need of much further work. The increased expectations are inappropriate, unrealistic and not informed by research evidence from around the world. Such research stresses the importance of building firm foundations through rich, challenging and meaningful experiences which build on and extend children's informal, intuitive understandings. Premature formalisation and rapid progress through a content laden curriculum will not develop a secure foundation for further learning.

The proposed content is much more demanding and is likely to result in superficial understanding, patchy knowledge and a poor foundation for further study. There is a real risk that considerable re-teaching of earlier content will be required as children move from one key stage to the next.

The difference in presentation of primary and secondary programmes of study is not helpful for teachers concerned with transition between these phases. An indication of how the programme of study contributes to progression in the aims should be at the start of each programme of study (not just KS3 and 4) and notes and guidance are needed for both primary and secondary (not just primary).

The articulation of expectations in relation to the aims is useful in KS3, even though some bullet points seem to be in the wrong place. For example only the last two bullet points under 'reason mathematically' are actually about reasoning, the first three seem more relevant to 'develop fluency' and the third could be about 'solve problems'. Similarly under 'solve problems' the final bullet point, whilst welcome, could be seen to be about pedagogy.

For primary there has been some improvement from the first draft (June 2012):

- The notes and guidance are better
- The removal of binary so that the focus is on the base-10 number system
- The correct use of SI units
- The removal of some standard units of measure from Y1 (note that the expectations for measures and time are still excessive in KS1)
- The delay of formal written methods until KS2
- Some errors in the mathematics have been addressed (for example, triangles are now classified as equilateral, isosceles and scalene, although there is nothing about classifying by the greatest interior angle (acute-angled, right-angled, obtuse–angled));
- Slightly less use of the words 'practice'/'practise'
- The removal of the words 'subtraction with borrowing', 'right triangular prisms', 'non-integer division' and 'non-polygon'
- A general overall improvement in the quality of the language used

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We feel that the following are still issues relating to content:

Number: calculation and accuracy / Number: number theory

- There needs to be greater emphasis on mental methods and how these contribute to the conceptual understanding of number and number operations, research evidence suggests that mental mathematics is the key to later success in algebra
- There is insufficient emphasis on the relationship between different number operations, which is necessary for algebraic thinking
- Despite the focus on the base-10 number system, knowing multiplication facts up to 12x12 is included in the primary curriculum – we would argue that understanding and knowing up to 10x10 is sufficient because other facts can be derived from these
- For calculation, methods are being implied by the use of language such as 'the efficient', 'columnar addition and subtraction', and 'short/long multiplication and division' – methods are only efficient if children are secure in their understanding of them, and teachers should be free to exercise professional judgment about when and how to introduce different calculation methods. One of the joys of mathematics is the variety of successful routes that can be used to tackle problems which can be evaluated in terms of efficiency and elegance
- Fractions: the expectations are still far too ambitious, too early - the arithmetic of fractions is best left to KS3, giving primary teachers the opportunity to develop deep foundations for general fraction work, including 'fraction of'.
- At KS3 the title 'number theory' is a misnomer as the proposed content has little to do with this discipline. The content is so sparse that it could be taught in a few lessons so we would question the need for it to be separate at all.
- Within number theory the inclusion of the vocabulary of sets (intersection and union) suggests a favoured pedagogical approach for Lowest Common Multiples and Highest Common Factors which may not necessarily be the most efficient or appropriate for all learners
- At KS3 references to mass, length and time would be better located in 'Geometry and Measure'

Algebra: expressing relations / Algebra: using equations and functions

- Algebraic thinking across the primary school is missing – this should not just appear in Y6 but as an element throughout the primary phase. In the highest performing jurisdictions algebraic thinking permeates the curriculum even in pre-school settings
- The expectations for graphs in KS3 are overly ambitious unless they are in modelling contexts with technology. An algebraic approach to direct and indirect proportion is inappropriate at KS3
- The separation of algebra into two strands is not helpful as it results in repetition
- Arithmetic progressions is usually an A level topic and its inclusion at KS3 seems bizarre, similarly geometric progression in KS4. During secondary mathematics a wide variety of sequences should be investigated and experienced including but

not limited to arithmetic and geometric progressions

Ratio, proportion and rate of change

- It is not helpful to separate ratio, proportion and rates of change from number and calculation, it would be better as part of the number strand (perhaps as a sub set of requirements)

Geometry and measures

- The development of symmetry and transformations is incoherent. Formal work on transformations is best left to KS3 (currently translation and reflection are in KS2). Symmetry properties are best left to KS2 (currently this is in Y2).Rotation symmetry is not mentioned at all. Transformational reasoning is mentioned in the KS3 programme of study but transformations are explicitly mentioned in KS4 (except translation and reflection in KS2)
- At KS3 enlargement is mentioned but there is insufficient detail about the level of demand expected. Negative scale factors should certainly not be included at KS3.
- Work on measures is too ambitious, before many young people have the prerequisite understanding: e.g. hours, minutes, seconds in Y1, accurate measurement of m/cm, kg/g, l/ml and ºC in Y2; in Y5 conversions between Imperial and metric depend on number concepts that are unlikely to be fully developed

Probability and Statistics

- The separation of probability and statistics is unhelpful and undesirable
- Probability, an essential skill for the 21st century has been removed from primary and separated from statistics in KS3. Practical work related to probability needs to be included. Foundations for formal work on probability in KS3 need to be laid in primary.
- At KS3 there is no mention of using probability and statistics to assess likelihood and risk. Only theoretical probability is explicitly mentioned. There should be an expectation that students will conduct probability experiments and compare experimental and theoretical outcomes.
- Data handling has been reduced and is incoherent – the statistical problem solving cycle needs to be at the fore in all key stages, given our data-rich society

General Content Commentary

- There is a misunderstanding of how valuable calculators and ICT can be in supporting children as they develop an understanding of the fundamentals of mathematics through exploration, investigation and problem solving. The only mention of ICT in the KS3 programme of study is for calculation, it should be included to support learning of sequences, graphs, functions, transformations, statistics and probability
- Problem solving references should go beyond word problems to encompass frequent references to a range of problems within and beyond mathematics

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These comments relate to the presentation of the content:

- Without knowing what the accompanying assessment regime will look like, it is difficult to imagine how this curriculum will be enacted in schools and classrooms
- In the absence of instructions to the contrary, schools are likely to divide teaching time equally between the strands so it is important that the distribution of the content is given careful consideration
- The bulleted statements include varying levels of detail – some of the statements are vague and lack focus
- The content needs a lot of translation – a rationale needs to come through from the clear aims and notes and guidance at all key stages
- The language used – 'practice', 'fluent', 'rapid recall', 'the efficient' – implies an unnecessarily limiting range of pedagogies and ways of working. We would like to see words such as 'explore' and 'investigate' used and given a higher profile. In addition, we believe that it is important to recognise that there may be many different routes to the same answer, and learners should develop a repertoire of strategies from which they may choose depending on the context and their confidence
- The implication is that techniques and procedures should be taught and then applied – however we would argue that practical contexts should come first and that learning through problem solving, modelling, exploration and investigation needs to be alongside practice in order to secure deep conceptual understanding
- Despite welcome statements about the inter-connectedness of mathematics, the content of the curriculum is set out without any demonstration of this – which may result in teaching (and as a consequence, learning) being instrumental rather than relational. An example of the use of a diagram to show the interconnectedness of mathematics has been developed by National Numeracy (2013) and is shown below. We commend National Numeracy's pathways diagrams to you. Ways must be found to present the programmes of study that demonstrate progression and connections, which will be helpful to both teachers and wider stakeholders (e.g. parents/carers and employers)
- Relating to the previous comment, we are pleased to see references to using mathematics across the curriculum (the numeracy statement 5.5) and would welcome explicit references to this being made in mathematics and also in the programmes of study for other subjects – in addition, these expectations/suggestions for mathematical working across the curriculum must be cross-referenced for consistency of pitch. At the moment the numeracy statement is a more exciting portrayal of mathematics than the programmes of study

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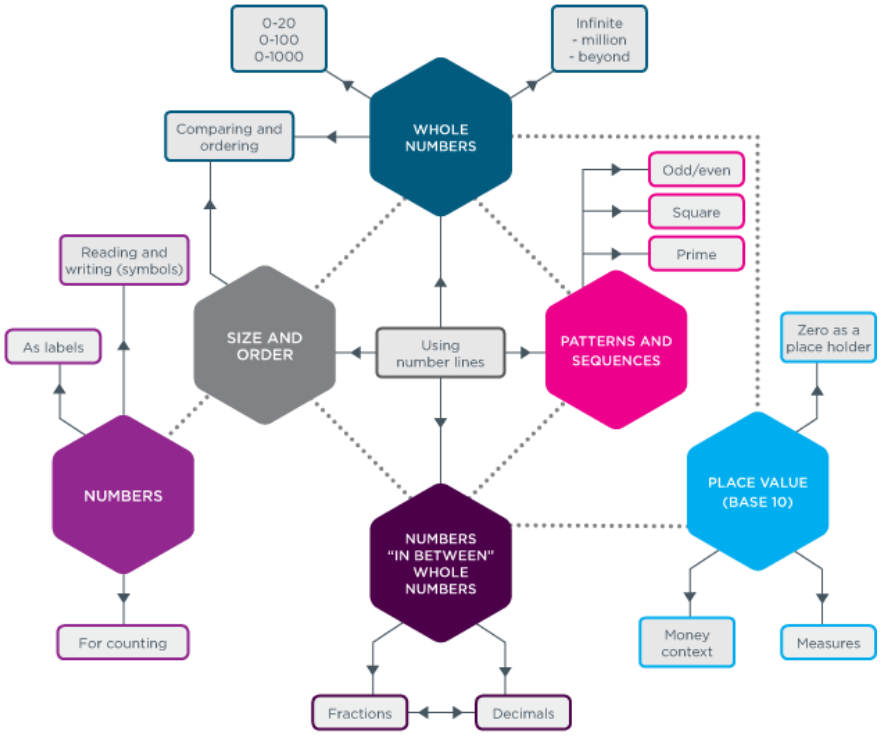

These comments relate to the pitch of the content:

- We note that many objectives have been moved from higher to lower years, in line with the raised expectations in EYFS. Whilst some high attaining pupils may thrive on the higher expectations, depending on how they are taught. However, they are not appropriate for the full range of learners and there is also a danger of acceleration at the expense of breadth and depth of understanding
- The mathematics community is **unanimous in its belief that breadth and depth are better for securing strong mathematical foundations than acceleration**, so we would urge some reconsideration of the increased demands particularly in respect of fractions, measures and transformations at primary
- For significant numbers of learners (many of whom are in 'protected characteristic groups'), we are concerned that there is simply too much content of a higher level which may result in them falling further behind year on year
- For all pupils, there is the possibility that greater amounts of 'harder' content will result in pupils superficially knowing a lot but actually knowing far less at a deep level. Research by Borthwick and Harcourt Heath (2012) suggests that where pupils had a deep understanding of calculation methods that built on their mental strategies and involved strong models and images, they were far more likely to get the right answer than when they attempted what are often described as compact or 'efficient' methods.
- The prescription of the content and the inclusion statements set out in 4.3 may actually result in very little differentiation happening in classrooms
- The content is demanding of teachers – see our more detailed comments about this in q11 – we feel that good mathematics teachers could teach this curriculum well to many learners. However, it is too demanding for the majority of teachers

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and will result in unconfident and superficial teaching.

- The performance orientated culture has resulted in teaching to the test rather than teaching for understanding. A content heavy curriculum which includes more demanding material is only likely to exacerbate the situation.

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4 **Does the content set out in the draft programmes of study represent a sufficiently ambitious level of challenge for pupils at each key stage?**

	Sufficiently ambitious		Not sufficiently ambitious		Not sure

Comments:

The current programmes of study are too ambitious, for all but the highest attainers, and are setting up children and their teachers to fail. We are concerned that much of the current content has been moved to earlier year groups and this matches the changes to the EYFS curriculum, which we oppose. At secondary the expectations for the end of KS3 and KS4 are what is currently achieved by just a tiny proportion of students: the KS4 curriculum should subsume KS3, to ensure all students have the opportunity to master KS3 ideas.

Aubrey and Durmaz (2008) claim that international comparisons find no advantage in the English early start to formal education and argue that it is likely that low attainers are least advantaged by a fast-paced curriculum which lacks time for consolidation, especially through whole class teaching. Their findings emphasise the “importance of a balanced pre-school education”, and suggest that “…children with little mathematical knowledge at the beginning of formal schooling will remain low achievers throughout their primary school years” (ibid. 2008: 9).

A longitudinal study from the USA agrees with these findings arguing the importance of early number competence for setting children's learning trajectories in elementary school mathematics: the kindergarten level of attainment correlated with attainment at third grade. “Understanding of numbers and number relations makes formal mathematics more accessible …. If children leave kindergarten with weak number competencies, especially with respect to operational knowledge and skills, they will enter first grade at a disadvantage and may never catch up to children who started with good number competences... A seemingly circumscribed problem early on can trigger more problems as development progresses (Karmiloff-Smith, 1998; Thomas & Karmiloff- Smith, 2003).” (Jordon et al., 2009:864).

One of our key concerns is that children will be moved on to harder content too quickly and before they have a good understanding of the concepts on which they are expected to build. Those leaving the foundation stage without secure understanding of basic number knowledge and counting, are those who are likely to struggle to keep up with these raised expectations for KS1 and KS2. If EYFS teachers are focused on moving children on to harder content such as counting on (which is more suitable for six and seven year olds) then some children may enter KS1 without the necessary understanding and skills to engage with the new curriculum (Montague-Smith and Price, 2012:60). The demand of the proposed curriculum is such that teachers are certain to inherit students with major gaps in their understanding and then feel under real pressure to move on before these weaknesses have been properly addressed.

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Although there have been some welcome changes between draft 1 and draft 2, there remains a rush to introduce formal representations which contradicts research evidence that emphasises the importance of developing secure conceptual understanding (Nunes et al., 2006; Nunes and Bryant, 2009; Nunes, Bryant and Watson, 2010) and number sense. A sense of number is what enables us to estimate, to calculate mentally and to identify errors in our written calculations. Number sense includes an appreciation of the inherent structure and underlying patterns that define the base ten number system, including place value, and enabling counting from any number in steps of any size. It must come first. We support the emphasis on counting in different step sizes, forwards and backwards.

In most of continental Europe children are introduced to the abstract symbolic representation of mathematical ideas in their first year of formal schooling at the age of six or seven (e.g. Switzerland and Hungary). Children do no written recording of mathematical ideas before that time other than through making marks of their own choosing. They are introduced to a whole range of mathematical tasks and games that give them concrete experiences of mathematics in meaningful contexts and which make connections between different mathematical topics. These experiences provide a strong foundation for careful development of the formal representations of mathematical expressions. This approach ensures that the majority of children in the class are fluent with basic addition facts and properties of numbers to twenty by the end of their first year of formal schooling. In the second year they are then in a position to move on to exploring multiplicative relationships, quantities, measure and larger numbers.

Mental strategies need to be taught explicitly and learners encouraged to make use of a number line and to make any appropriate jottings. These skills later form the foundation for written methods. Without mental methods and number sense, written methods become simply procedures which are performed without understanding. Without the ability to estimate, answers are likely to be accepted with no consideration for their reasonableness. Children also need to understand the symbols they are using. For example '=' does not mean 'makes' but 'is equal to' so children need to be happy that 3=4-1=2+1=6÷2=10x6-57 etc. Comparing quantities is a much more natural approach for young children than considering their equality and so comparisons should form a much larger part of the children's mathematical experiences using the symbols > and < to express relationships

Calculating with number sense is asking children to 'mathematise', to examine numbers before they calculate, to use mental methods and above all to think before invoking standard procedures. It is not always appropriate to use a written method as sometimes a mental strategy will be quicker or less likely to result in error; for example, column methods aren't always the most efficient e.g. 699+72 or 1002- 9. Children need to become flexible. This empowers them; they thrive on creative and constructive opportunities to develop number sense (Twomey, Fosnot and Dolk, 2001a) and see mathematics less as a 'dogmatic, dead discipline' and more as a living creative one.

We have two key concerns relating to the changes in expectations:

- Will these raised expectations lead to more children being identified as failures as they struggle to achieve at the new standards?
- Will these raised expectations lead to content being covered without children developing appropriate levels of understanding?

Developing understanding takes time and there simply may be too much content for each year group to allow for this to happen. Understanding is developed through exploration, tackling problems, talking, making connections, using manipulatives and drawing representations.

If there were less content at KS1 then there would be more time to develop these strong foundations of deep understanding and this may lead to children having more capacity to learn a greater amount of more advanced content later because the foundations have been secured. The same is true for subsequent key stages. We are particularly concerned that many primary children will become disaffected and disengaged and not be 'secondary ready'. Without secure foundations, there is little to build on. Children may superficially perform at the expense of understanding. Will our children end up with a trivial, 'phrase book' grasp of many ideas rather than a deep level of understanding of a few?

ACME (2012), in its report *Raising the Bar*, suggest that across the 5-16 age range, young mathematicians, "benefit most from an approach that aims to enrich and deepen the content of the curriculum, focusing on enabling students to achieve a deep mastery of the material. Acceleration through the curriculum promotes superficiality, not the true depth and rigour of knowledge that is a foundation for higher mathematics."

We know that many pupils do not enjoy mathematics (see below), and there is a danger that with the higher expectations and early formality of this proposed curriculum, levels of enjoyment – and consequently of attainment – will drop even further. Over the past 20 plus years, much research has been undertaken on pupil attitudes to mathematics, and there is on-going documentation of learners' disengagement from the subject, despite their level of educational achievement (Buxton, 1981; Hughes, 1986; Askew and Wiliam, 1995; Hannula, 2002; Klein, 2007; Boaler, 2009; Askew et al., 2010; Borthwick, 2011 and 2008; Marks, 2011). Evidence from 1999 TIMSS, in both England and New Zealand (a 'higher performing' country) showed student attitudes to mathematics as declining over their school years (Walls, 2009; Askew, 2010).

Interestingly, Askew et al. (2010) found that high-performing countries, in terms of international comparisons, are as concerned about students' negative attitudes to the subject as England is. The authors argue that in an excessively exam-driven culture, enjoyment is achieved through success attained, rather than learning itself. They go on to make the rather disheartening statement that "High achievement and pleasure in learning mathematics are difficult goals to reconcile." (ibid. 2010: 20).

The fact that mathematics can be reductively viewed as merely about 'right' and 'wrong' may contribute to children experiencing success or failure and consequently being labelled. This happens especially where the curriculum is about practising procedures

and recalling facts. This style of curriculum perpetuates the idea of mathematics being 'hard' and will not address the kind of attitudes that we hear so often in relation to mathematics – 'I can't do maths … I was never any good at it!'

But what does it mean to be good at mathematics? An investigative and problem-solving approach to learning ensures that children get used to collaborating, coming to more than one answer, making decisions about appropriate approaches, discussing their learning and developing as mathematicians, not just as regurgitators of the right answer. We understand that the government does not want to be seen to be prescribing pedagogy however there is an implied pedagogy throughout the draft of a curriculum based upon right and wrong.

In high performing jurisdictions such as Singapore and Massachusetts, mathematical proficiency embraces not just skills, but also concepts, processes, metacognition and attitudes, with problem solving being central to mathematics learning. We recommend that a similar approach is taken in this document and is reflected in the aims, attainment targets and non-statutory guidance. It is also worth noting that formal schooling does not begin until the age of 6 or 7 in these high performing jurisdictions and their Y6 curriculum is for 12 year olds rather than 11 year olds.

In general, we believe that caution must be exercised when reading comparative data and using international comparisons to reach judgments on mathematics education. There are cogent arguments concerning the shortcomings of international comparisons in the literature (Brown, 2010, Askew et al., 2010), and as Michael Gove said in connection with benchmarking against the most successful school systems: "This... has to be done with great care to avoid learning the wrong lessons from countries with very different cultures." (Oates, 2010: Foreword).

Response from ATM and MA

5 **Do you have any comments on the proposed wording of the attainment targets?**

Comments:

The current wording is vague and it is not clear what it will mean in practice as no information about assessment and accountability has yet been provided. We are concerned that the removal of levels will result in schools going their own way with systems that are not consistent from school to school. This will seriously hamper children's progress particularly if they have to move school.

The attainment targets are written in rather a 'stark' way with no suggestion of the small, intermediate steps necessary to lead up to the targets. Because these are not made explicit, the progression in the content from year to year is unclear. This means that it will be down to individual teachers to make these connections and to build appropriately on prior learning which relies on teachers having appropriate subject knowledge. We will come back to this issue later.

As stated earlier, we would like to see references to the teaching of problem solving and reasoning through the programmes of study and as attainment targets. This is the only way to ensure that they will happen.

We understand that the notes and guidance are non-statutory. However we are aware that many teachers will read these as though they were statutory. There are certain phrases that are used frequently and which could suggest a particular limited pedagogy. We believe that there is too much use of words such as 'practise', 'the efficient', 'rapid' and 'recall' which imply a certain way of teaching. Changing the wording from 'the efficient' to 'any efficient' method would be a small but significant improvement. We would like to see words such as 'investigate', 'explore', 'describe' and 'explain' given more prominence in the document.

Connected with this is the issue that the presentation of the aims and the language used within them suggests that problem solving is something that comes after fluency has been achieved. In other words, practise a procedure until you can do it and then use it to solve problems. We would suggest that fluency can be achieved <u>through</u> the solving of problems. In other words, *use it to get it* rather than *get it then use it*!

Response from ATM and MA

6 **Do you agree that the draft programmes of study provide for effective progression between the key stages?**

	Agree	✓	Disagree		Not sure

Comments:

We have already described (in our response to earlier questions) our concerns with regards to children being moved on too quickly before understanding has been established. The difference in presentation of primary and secondary programmes of study is unhelpful and unnecessary and could act as a barrier to progression between these phases. Transition will also be hindered if the replacement for National Curriculum levels turns out to be unwieldy, unsophisticated and uninformative.

Clarity is needed for schools regarding the expectations of when content will be taught. We understand that the requirement will still be for content to be taught by the end of the key stage however the way the content is currently presented may result in some schools simply teaching what is specified. Schools need to exercise their right and professional duty to shift content between year groups in a given key stage in order to create the most appropriate progression for their pupils within that key stage.

We recommend that primary content should be set out in two-year phases rather than for individual year groups, as this may provide more licence to teachers and schools to make professional judgements about when, over the two-year cycle, new concepts are introduced to their learners. In order to support schools in developing their mathematics curriculum and providing suitable learning opportunities alongside demands from other subjects, this two-year cycle needs to clarify progression as this will help teachers to build upon what has come before and to prepare children for what is to follow.

The issue with moving between year groups, key stages and schools is that there are proposals to remove the language of levels. Whilst we do not approve of the way in which many schools use levels (especially the use of sub-levels), we appreciate that this is a universal and successful way of describing pupils' attainment as they move between year groups, key stages and schools. Removing this system is to remove the effective language to describe attainment within and between schools and also with parents and carers.

We are naturally concerned that pupils who are already in school and working towards the existing National Curriculum will be at a disadvantage if this curriculum is to be introduced. Children who may be attaining at currently expected levels will soon find themselves not meeting standards when these rise. Those children who are currently in KS2 will be particularly vulnerable and deferring the changes to the National Curriculum tests until 2016 is not long enough for these groups to reach these revised expectations.

Response from ATM and MA

7 **Do you agree that we should change the subject information and communication technology to computing, to reflect the content of the new programmes of study?**

	Agree	✓	Disagree		Not sure

Comments:

The expectations of the computing programme of study are unrealistic and do not fit well with mathematics. We recommend that children should develop ICT capability in primary school and computing should be left to secondary when there might be more of a chance of having teachers with appropriate expertise.

Response from ATM and MA

8 **Does the new National Curriculum embody an expectation of higher standards for all children?**

	Yes	✓	No		Not sure

Comments:

The proposed curriculum does not represent an aspirational 21st century curriculum. It is regressive, promoting fluency through practice in standard algorithms – our knowledge of how children learn and society's needs have moved on since the late 19th century. A modern curriculum needs to inspire learners and help them to develop the skills that will be needed for a modern, technological, globalised society.

We know that there is some very good teaching of mathematics already happening in UK schools (Ofsted, 2011 and 2012) however we know that in many schools this could be better. We do not believe that the approach taken by the government through this draft curriculum is the solution to the nation's problems.

There is no evidence from anywhere in the world that this curriculum is achievable by most children and we have concerns, expressed at length earlier, that this could result in children being labelled as failures from an early age.

We are concerned about the impact of these raised expectations on teachers. It seems as though some year groups are more vulnerable than others to weak teachers failing to meet these new expectations because the difference between where the children are now with the current curriculum and where they need to be with the new is variable.

We draw your attention to our earlier responses with regards to the implication of raised expectations and the fact that teaching harder content earlier may simply widen the attainment gap rather than serving to close it. Harder mathematics does not lead to higher standards, however deeper thinking and conceptual development do. As the curriculum currently stands, it will not ensure higher standards for the majority of children – quite the opposite. Rather than introduce a new curriculum, investing in improvements in the standard of teaching through teacher development and in the quality of external assessments might have a more significant impact on standards.

Response from ATM and MA

9 **What impact - either positive or negative - will our proposals have on the 'protected characteristic' groups?**

Comments:

Ofsted (2012) reports that children unlikely to meet the government target are currently seriously neglected and tend to get an impoverished experience of mathematics. This situation is likely to be exacerbated with the increased expectations.

We understand that this group of children is of particular interest to ministers: however, we are struggling to see how the proposals within this draft curriculum will support them in developing as capable mathematicians who enjoy the subject and are keen to study it post-16.

“This [portraying long division as the pinnacle of achievement in maths at primary school] is about the worst maths marketing you can do to prospective students - and in the long term to parents... Worse still, why imply that those tedious procedures are what maths is primarily about?” (http://www.conradwolfram.com/home/should-long-division-be-the-pinnacle-of-primary-mathematics-educat.html)

This group of ‘protected characteristic’ children will be particularly vulnerable to what we described earlier in terms of the gap widening between the top and bottom of the attainment scale. Often low attainers are taught by a teaching assistant rather the class teacher and this raises the issue of both teachers and teaching assistants having adequate mathematical subject knowledge as well as an understanding of appropriate subject specific pedagogy in order to best support these groups.

This group of learners may find themselves hearing messages from parents at home that ‘maths wasn’t for me’ or ‘I can’t do maths, it doesn’t matter’ and so on. It is therefore extremely important that they both hear positive messages about mathematics and have positive mathematical experiences in school. Wider society already feels that mathematics is a hard subject and that it’s OK to say ‘I can’t do it’. What is proposed doesn’t change this, if anything it exacerbates it.

The content is excessively prescribed in some areas (e.g. insisting on particular methods for division) that it will limit children’s creativity, thinking and opportunity to respond flexibly to tasks. Therefore, we anticipate that this will negatively impact on most of the groups.

As this is a group of children who often move schools, the universal use of levels to describe their attainment was a useful tool. A child arriving in a class would come with a level enabling the class teacher to immediately start pitching work appropriately and addressing their needs. The removal of levels will particularly impact on children moving between schools as schools will lack a common language to describe attainment and need.

Response from ATM and MA

10 **To what extent will the new National Curriculum make clear to parents what their children should be learning at each stage of their education?**

Comments:

The proposed National Curriculum lacks clarity and detail. Some of the statements in the programme of study are difficult for qualified mathematics teachers to interpret and are consequently likely to prove completely impenetrable to most parents/carers. The content of the curriculum is skewed towards the highest attainers so parents/carers will not be able to rely upon it as a benchmark of typical attainment.

For over 10 years, schools have educated parents in the informal calculation strategies such as number lines and the grid method for multiplication. In our experience parents/carers have been visibly thrilled at these 'new' methods and have reported that their children now have better attitudes to mathematics, and are more confident and successful at it. The new content at best down-plays and at worst removes these approaches. This is not helpful.

We appreciate that schools will be expected to share their school curriculum with parents/carers via their websites. Parents/carers who have engaged with the National Curriculum may be concerned where schools have exercised their right to move content between year groups within a key stage. In order to support parents/carers and schools, this needs to be made clearer.

We imagine that parents/carers whose children are not meeting the expectations for their year group will be particularly concerned. We would question whether setting content out in this way supports parents/carers as it may lead to anxiety over their child's performance.

Parents/carers are familiar with the idea of their child being given a level to describe their performance and schools have invested a lot of energy in ensuring that parents/carers understand this language. The removal of a universal language and the introduction of ad hoc systems will confuse parents/carers and lead to worries about their children's progress at and between schools.

Response from ATM and MA

11 **What key factors will affect schools' ability to implement the new National Curriculum successfully from September 2014?**

Comments:

One of the main barriers to successful implementation is teacher subject knowledge and understanding of subject specific pedagogies and good practice. For many years now, teachers have been working with National Strategy documentation which has in many ways deskilled the profession as these documents have provided the structure for long-term planning and have ensured progression across a year and between years.

Most teachers will not feel confident implementing the proposed curriculum, partly because the expectations are over ambitious and they know their children won't be successful in the suggested timescale. The other reason is that many teachers have become familiar with the strategies for mathematics advocated by the National Numeracy Strategy including the use of models for number, emphasis on mental strategies and careful development of understanding before introducing formal methods. They may lack confidence in some of the methods advocated, such as long multiplication and long division, both of which are redundant skills when we have calculators in our pockets on our mobile phones.

Professional development will need to be provided to enable teachers to develop the necessary knowledge and understanding to support learners' progress through the increased level of challenge in this curriculum. If these significant CPD needs are met then colleagues in schools will feel empowered to make the most of a new curriculum and plan 'exciting and stimulating lessons'. We are concerned that there are no proposals to give schools additional INSET day(s) in order to provide time for colleagues to share and develop good practice. Although as a group we are only concerned with mathematics, we appreciate that schools are tasked with meeting the requirements of changes to the curriculum across all subjects (and writing a school curriculum) and therefore the more time and resources that can be provided for schools, the better.

In order to support schools to plan from the Programmes of Study, we would recommend that the guidance part of the pages is used to provide pedagogical support and subject knowledge for teachers. This could include exemplification of how manipulatives can be used to support conceptual understanding. For example, in Y1 addition and subtraction, the notes and guidance mention the use of 'concrete objects and pictorial representations' without providing images or examples of good practice to support teachers.

This guidance could also suggest opportunities to: reason mathematically, follow lines of enquiry, solve problems (including real life problems), persevere and be curious (as set out in our aims); recommend useful contexts for exploring the mathematics; identify links between this and other areas of mathematics / other subjects; making reference to high quality, freely available / common research-backed resources to support learning

developed by the subject associations and others (e.g. Bowland Maths, NRICH, Nuffield, STEM library, etc.) This would be in line with current practice in Flemish Belgium and Hungary.

There is a danger that any specific statements about the method of teaching will hinder the development of a school's mathematics curriculum as they will be seen as prescriptive and therefore limiting. However on the other hand, we are concerned that if the National Curriculum lacks useful guidance, then schools may resort to published schemes as they did prior to the introduction of the National Strategies. Teachers should have sufficient information to allow them to make professional judgements about mathematics teaching. The expertise available in the mathematics community should be drawn on to ensure that the level of guidance within the Programmes of Study is appropriate.

The MaST programme is a successful programme that has developed some fantastic leaders of primary mathematics who will be well-placed to lead their schools through these changes. We would recommend that access to this programme be widened by reinstating financial support for participants.

Schools will be interested in what finance and resources will be available to them. If schools do not have mathematical expertise in-house then they will need to buy in this support and therefore extra money to do this will be necessary. Without this money, there may be a negative impact on the teaching of mathematics.

Understandably schools will want to start working towards successful implementation of the new curriculum and will also be concerned with how they will be held accountable by Ofsted. Joined up thinking between the National Curriculum and Ofsted is essential and revised Ofsted requirements should be published in September 2013. We have noticed a number of inconsistencies between the content of recent Ofsted publications (2011 and 2012) highlighting the best practice in mathematics teaching and this curriculum.

The testing and accountability regime will have an impact on how the curriculum is enacted and as such needs to be developed in conjunction with it. Northern Ireland has run into problems through developing its assessment regime after its new curriculum (reported at the June 2012 meeting of the Joint Mathematical Council) and this should be avoided. In practice, teachers will look to the instruments of accountability as a means of understanding the curriculum requirements and expectations.

There are implications for Initial Teacher Education (ITE) in 2013-14 as institutions attempt to very quickly understand the requirements of the new curriculum in order to prepare beginning teachers to teach it. We know that student teachers on a one-year programme receive only a minimal input on mathematics and therefore we are concerned about the preparedness of newly qualified teachers to work with a new curriculum from September 2014. If there were a longer lead-in time, then ITE providers could ensure student teachers were familiar with the curriculum and this would also give schools longer to prepare to meet raised expectations.

Response from ATM and MA

12 **Who is best placed to support schools and/or develop resources that schools will need to teach the new National Curriculum?**

Comments:

It is essential that support for schools stretches beyond the first year (2013-14) as it will take time for schools to embed a new curriculum.

Unfortunately there are now very few local authority consultants left. These professionals understood the needs of schools in their locality and these historical networks would have been ideally placed to provide consistent support across England. In their place are independent providers of varying quality and capacity which will result in fragmented and inconsistent support across the country.

We welcome the development of the NCETM CPD lead programme but question whether this will ensure quality support to schools as those attending the course are self-appointed and self-regulated beyond an initial assessment. We are also interested in materials being developed by Ofsted and hope that these will be in-line with new expectations. We would like the existence of high quality useful materials to be made clear to schools.

Of course, where schools lack expertise they will look to publishers for a scheme to help them through these changes. We believe that these will be prolific and rushed out in order to be in place as soon as possible. The Government is deliberately not telling the profession how to teach so is it wise to leave this to publishers who are motivated by commercial and financial targets? We recommend that a group of quality providers including the subject associations are funded to come together to provide more detailed non-statutory notes and guidance so that schools do not need to resort to commercial providers in the first instance. In the highest performing jurisdictions, textbooks and resources to support learning and teaching are produced by teams of teachers, curriculum developers and teacher educators/ researchers who have expertise in the area. This is funded by governments who would not consider leaving something so important to unaccountable commercial interests.

The subject associations are well-placed to support schools because they have a vast reservoir of expertise and knowledge. However both of the mathematics subject associations rely on volunteers and therefore do not have the capacity to provide support to individual schools. It is anticipated that guidance and support from the associations will develop through our journals and publications in the months and years following the publication of the new curriculum in September 2013. We recommend that membership of a subject association for mathematics (and likewise other subjects) be funded by Government or at the very least recommended to schools. Institutional membership of ATM and/or MA would ensure that mathematics subject leaders in schools have access to authoritative, grounded advice, support and ideas from those who understand and care about the teaching of mathematics.

There is some fantastic expertise within schools, particularly among ASTs and MaST

teachers however there are simply not enough of these colleagues in schools. We are certainly far from having a mathematics specialist in every primary school as recommended in the Williams report on primary mathematics (DCSF, 2008).

New emerging support structures, such as teaching schools, need more time to develop. We doubt that schools that are getting to grips with the changes for themselves will have the capacity to support others.

The current arrangements for schools encourage competition rather than collaboration which may militate against high quality implementation informed by best practice.

Response from ATM and MA

13 **Do you agree that we should amend the legislation to disapply the National Curriculum programmes of study, attainment targets and statutory assessment arrangements, as set out in section 12 of the consultation document?**

	Agree	✓	Disagree		Not sure

Comments:

No, we strongly believe that the proposal to disapply the current programmes of study, attainment targets and statutory assessment arrangements with effect from September 2013 would be an unnecessary and retrograde step. It will create an entitlement void for at least two years (longer if the introduction of the new KS4 National Curriculum is delayed), destroy the credibility and status of the existing curriculum and may provoke unintended and detrimental consequences. This is evident from the extremely negative media commentary on ICT following the announcement of disapplication and the subsequent abandonment of this subject in many schools. The current curriculum should remain statutory as it defines a minimum entitlement for learners. There is no reason why teachers shouldn't include more than is in the current curriculum. Schools need to be accountable and better the current curriculum than a 'free for all'.

We agree that schools will need time to implement any changes to a curriculum. In order to plan for the necessary changes in 2013-14, schools and ITT institutions will need the final curriculum in advance of the start of the academic year.

It will be helpful to schools to receive some guidance on what is the same with regards to content and what is new so that they can focus their efforts during this year. There are obvious CPD implications for staff as outlined in this response and funding to buy in support and extra INSET days to prepare during this period will be appreciated by all schools. Guidance on how to get ready for the changes will also be popular with some. A longer lead-in time would be better to enable schools to get best ready for this.

Response from ATM and MA

14 **Do you have any other comments you would like to make about the proposals in this consultation?**

Comments:

We feel that this is a missed opportunity to reflect and build on current best-practice from within our shores whilst also looking ahead to the skills that our children will need in the 21st century and beyond.

If we are to prepare young people to achieve their very best in the 21st century, high-tech, data-rich world we need a curriculum which nurtures creative and flexible problem solving, confidence to 'have a go' and determination to seek alternative approaches and not give up. The curriculum must encourage criticality and an appreciation of the importance of being able to justify an answer. This includes accuracy and fluency, as well as the ability to work with others and communicate effectively. The curriculum must leave children knowing that mathematics makes sense and can be understood.

The ATM and the MA view mathematics as an interesting, useful and creative subject, with many interconnections and links with other subjects and to real life, through which children develop an enthusiasm and curiosity for learning mathematics and using that knowledge to solve problems in the widest sense. This view is not restricted to a small clique of subject association members, but is commonly found across the mathematics teaching profession in the UK and abroad (e.g. Poland, the Netherlands).

Rote learning and procedural competence are widely recognised as an inadequate basis for this; only by developing deep mathematical understanding will the Government's aspirations for a mathematically educated populace be achieved.

Response from ATM and MA

15 **Please let us have your views on responding to this consultation (e.g. the number and type of questions, whether it was easy to find, understand, complete etc.)**

Comments:

The choices for question 4 did not allow us to respond that the content was inappropriately ambitious.

References:

ACME (2012) Raising the Bar
http://www.acme-uk.org/media/10498/20121212_acme_raising_the_bar.pdf.pdf

Andrews, P., (2006) 'Conditions for Learning', *Mathematics Teaching* 194 (January) 10 - 14

Andrews, P., and Sayers, J., (2006a) 'Mathematics Teaching in Four European Countries', *Mathematics Teaching* 196 (May) 34 - 38

Andrews, P., and Sayers, J., (2006b) 'Conditions for Learning: Part 3', *Mathematics Teaching* 199 (November) 34 - 38

Andrews, P., and Sayers, J., (2008) 'Conditions for Learning: Part 4', *Mathematics Teaching* 209 (July) 10 - 13

Anthony, G., and Walshaw, M., (2007) *Effective Pedagogy in Mathematics/ Pāngarau: Best Evidence Synthesis Iteration [BES]*. Wellington, New Zealand: New Zealand Ministry of Education

Askew, M., (2010) 'It ain't (just) what you do: Effective teachers of numeracy', in I. Thompson (ed.) *Issues in teaching Numeracy in Primary Schools*. Maidenhead: Open University Press

Askew, M., and Wiliam, D., (1995) *Recent Research in Mathematics Education 5-16*. Ofsted Reviews of Research. London: HMSO;

Response from ATM and MA

Askew, M., Hodgen, J., Hossain, S., and Bretscher, N., (2010) *Values and Variables: Mathematics education in high performing countries*. London: Nuffield Foundation

Aubrey, C. and D. Durmaz (2008) 'Still not getting it right from the start' in Thompson, I. (ed) *Teaching and learning early number* Maidenhead: McGraw-Hill

Boaler, J., (2009) *The Elephant in the Classroom: Helping children learn and love maths*. London: Souvenir

Borthwick, A (2011) Children's attitudes towards, and perceptions of their mathematics lessons. *Proceedings of the British Society for Research into Learning Mathematics (BSRLM)*. Vol. 31, No. 1. London: British Society for Research into Learning Mathematics (BSRLM). 37-42.

Borthwick, A. and M. Harcourt-Heath (2012) Calculating: What can Year 5 Children do now? *Proceedings of the British Society for Research into Learning Mathematics*, 32(3), 25-30.

Brown, M., Brown, P. and Bibby, T. (2007) 'I would rather die': attitudes of 16-year-olds towards their future participation in mathematics *Proceedings of the British Society for Research into Learning Mathematics (BSRLM).* Vol. 27, No. 1. London: British Society for Research into Learning Mathematics (BSRLM). 18-23.

Brown, M., (2010) Swings of the Pendulum, in I. Thompson (ed.) *Issues in Teaching Numeracy in Primary Schools*. 2nd edition, Maidenhead: OUP (first published: 1999)

Buxton, L., (1981) *Do You Panic About Maths?: Coping with maths anxiety*. London: Heinemann Educational

Conservative Party (2011) *A world-class mathematics education for all our young people*. (Task Force Report chaired by Carol Vorderman). http://www.conservatives.com/News/News_stories/2011/08/~/media/Files/Downloadable%20Files/Vorderman%20maths%20report.ashx

DCSF (Department for Children, Schools and Families) (2008) *Independent Review of Mathematics Teaching in Early Years Settings and Primary Schools* (The Williams Review). London: HMSO

DES (Department of Education and Science) (1982) *Mathematics Counts* (Cockcroft Report). London: HMSO.

DfE (Department for Education) (2011) *The Framework for the National Curriculum: a report by the Expert Panel for the National Curriculum review*. London: DfE. https://www.education.gov.uk/publications/standard/publicationDetail/Page1/DFE-00135-2011

Response from ATM and MA

DfE (2013) Education Minister, Elizabeth Truss, speaks at the North of England Education Conference (http://www.education.gov.uk/inthenews/speeches/a00220274/elizabeth-truss-speech)

Dweck, C. S., (2000) *Self-Theories: Their role in motivation, personality, and development*. Philadelphia, PA: Psychology Press
Hannula, M.S., (2002) 'Attitude towards mathematics: Emotions, expectations and values.' *Educational Studies in Mathematics* 49, 25 - 46

Education Act (2002) http://www.legislation.gov.uk/ukpga/2002/32/section/78

Hughes, M., (1986) *Children and Number: Difficulties in learning mathematics*. Oxford: Basil Blackwell

Jerrim, J. and Choi, A. (2013) *The mathematics skills of school children: How does England compare to the high performing East Asian jurisdictions?* London: Institute of Education (http://repec.ioe.ac.uk/REPEc/pdf/qsswp1303.pdf)

Jordan, N.C., D. Kaplan, Locuniak, M.N. and C. Ramineni (2009) Early math matters: kindergarten number competence and later maths outcomes *Developmental Psychology* 45(3) 850-867

Klein, M., (2007) 'How is it that learning mathematics in the early years can become so difficult? A post-structuralist analysis. *Contemporary Issues in Early Childhood* 8 (4): 313-319

Leong, Y. H., Dindyal, J., Toh, T. L., Quek, K. S., Tay, E. G., Lou, S. T. (2011) Teacher preparation for a problem-solving curriculum in Singapore *ZDM Mathematics Education* 43:819–831

Marks, R., (2011) 'Ability' ideology and its consequential practices in primary mathematics, Proceedings of the British Society for Research into Learning *Mathematics* 31(2) 43 - 48

Montague-Smith, A and A.Price (2012) *Mathematics in early years education* London: David Fulton

National Numeracy (2013) *Learning pathway 1: Numbers and the number system* http://www.nationalnumeracy.org.uk/understanding-numbers-and-our-number-system/index.html

NFER (National Foundation for Educational Research) (2008) *England's achievement in TIMSS 2007: National report for England*. NFER: Berkshire.

Nunes, T. Bryant, P., Hurry, J. and Pretzlik, U. (2006) *Fractions: Difficult but Crucial in Mathematics Learning* http://www.tlrp.org/pub/documents/no13_nunes.pdf

Response from ATM and MA

Nunes, T., Bryant, P. et al (2009) *Development of Maths Capabilities and Confidence in Primary School* https://www.education.gov.uk/publications/eOrderingDownload/DCSF-RR118.pdf

Nunes, T. Bryant, P. and Watson, A. (2010) *Key Understandings in Mathematics Learning* http://www.nuffieldfoundation.org/key-understandings-mathematics-learning

Oates, T. (2010) *Could do better: Using international comparisons to refine the National Curriculum in England*. University of Cambridge Examinations Syndicate. http://www.cambridgeassessment.org.uk/ca/digitalAssets/188853_Could_do_better_FINAL_inc_foreword.pdf

OECD (Organisation for Economic Co-operation and Development) (2009) *Viewing the United Kingdom school system through the prism of PISA.* http://www.oecd.org/dataoecd/33/8/46624007.pdf

Ofsted (Office for Standards in Education), (2011) *Good practice in primary mathematics: evidence from 20 successful schools*. London: HMSO

Ofsted (Office for Standards in Education), (2012) *Mathematics: Made to measure. Messages from inspection evidence.* London: HMSO

Ruthven, K. (2011) Using international study series and meta-analytic research syntheses to scope pedagogical development aimed at improving student attitude and achievement in school mathematics and science, *International Journal of Science and Mathematics Education* 9 (2), 419-458

Twomey Fosnot, C., and Dolk, M., (2001) *Young Mathematicians at Work: Volume 1, Constructing Number Sense, Addition and Subtraction*. Portsmouth: Heinemann

Walls, F., (2009) *Mathematical Subjects: Children talk about their mathematics lives*. London: Springer

Westminster Forum Conference (2013) http://www.westminsterforumprojects.co.uk/info.php?ref=V1N5WY1e&inf=pub

Williams, H. and Thompson, I. (2003) Calculators for all? in I. Thompson, (ed.) *Enhancing primary mathematics teaching*. Buckingham: Open University Press.

Response from ATM and MA

Thank you for taking the time to let us have your views. We do not intend to acknowledge individual responses unless you place an 'X' in the box below.

Please acknowledge this reply	✓
E-mail address for acknowledgement:	adminmanager@atm.org.uk; senioradministrator@m-a.or.uk

Here at the Department for Education we carry out our research on many different topics and consultations. As your views are valuable to us, would it be alright if we were to contact you again from time to time either for research or to send through consultation documents?

✓	Yes		No

All DfE public consultations are required to meet the Cabinet Office Principles on Consultation

The key Consultation Principles are:

- departments will follow a range of timescales rather than defaulting to a 12-week period, particularly where extensive engagement has occurred before
- departments will need to give more thought to how they engage with and consult with those who are affected
- consultation should be 'digital by default', but other forms should be used where these are needed to reach the groups affected by a policy; and
- the principles of the Compact between government and the voluntary and community sector will continue to be respected.

Responses should be completed on-line or emailed to the relevant consultation email box. However, if you have any comments on how DfE consultations are conducted, please contact Carole Edge, DfE Consultation Coordinator, tel: 0370 000 2288 / email: carole.edge@education.gsi.gov.uk

Thank you for taking time to respond to this consultation.

Completed questionnaires and other responses should be sent to the address shown below by 16 April 2013

Send by e-mail to: NationalCurriculum.CONSULTATION@education.gsi.gov.uk