

# Mathematics Matters

## An Executive Summary

In presenting this summary of the Mathematics Matters report, we have chosen to highlight the key questions and themes and provide a flavour of the responses of the (more than 150) mathematics educators who participated. Space does not permit us to demonstrate the full complexity of the findings and we urge you to read the full report when it is published in July 08.

*A full version of the report, the stimulus materials used, and a database of responses and lesson accounts – of particular use to teachers of mathematics – will be found at [ncetm.org.uk/mathematicsmatters](http://ncetm.org.uk/mathematicsmatters) in July 08.*

The logo consists of four overlapping circles in shades of blue and teal, arranged in a cluster.

National Centre  
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## Valuing what is important

Participants reiterated the central importance of mathematics in the curriculum, in particular citing its social, personal and intrinsic worth. They recognised that teaching should value each of the following learning outcomes:

Learning outcomes sought	Types of learning activity implied
<b>Fluency in recalling facts and performing skills</b>	<ul style="list-style-type: none"> <li>● Memorising names and notations</li> <li>● Practising algorithms and procedures or fluency and ‘mastery’</li> </ul>
<b>Conceptual understanding and interpretations for representations</b>	<ul style="list-style-type: none"> <li>● Discriminating between examples and non-examples of concepts</li> <li>● Generating representations of concepts</li> <li>● Constructing networks of relationships between mathematical concepts</li> <li>● Interpreting and translating between representations of concepts</li> </ul>
<b>Strategies for investigation and problem solving</b>	<ul style="list-style-type: none"> <li>● Formulating situations and problems for investigation</li> <li>● Constructing, sharing, refining, and comparing strategies for exploration and solution</li> <li>● Monitoring one’s own progress during problem solving and investigation</li> <li>● Interpreting, evaluating solutions and communicating results</li> </ul>
<b>Awareness of the nature and values of the educational system</b>	<ul style="list-style-type: none"> <li>● Recognising different purposes of learning mathematics</li> <li>● Developing appropriate strategies for learning/reviewing mathematics</li> <li>● Appreciating aspects of performance valued by the examination system</li> </ul>
<b>Appreciation of the power of mathematics in society</b>	<ul style="list-style-type: none"> <li>● Appreciating mathematics as a longstanding part of worldwide human creativity</li> <li>● Creating and critiquing ‘mathematical models’ of situations</li> <li>● Appreciating uses/abuses of mathematics in social contexts</li> <li>● Using mathematics to gain power over problems in one’s own life</li> </ul>

When participants were asked to compare their “vision for an ideal mathematics curriculum” with the values that are implied by the “curriculum that is currently implemented in most schools and other settings”, a clear pattern emerged. Participants consistently reported that:

- Too much time is currently spent developing “fluency in recalling facts and performing skills” to the detriment of other aspects.
- Much greater emphasis should be placed on the remaining four learning outcomes, with particular emphasis being placed on “Conceptual understanding and interpretations for representations” and “Strategies for investigation and problem solving”.

There was remarkably little variation in these views across phases of education and geographical areas.

**“use coaching to encourage risk taking and innovation by teachers.”**

Bean, Brunt, Pattison, Sutton

**“create productive opportunities in a variety of settings that require us all to work together to probe and work on these perceptions through the learning of mathematics (i.e. jointly explore mathematics).”**

Clarke-Wilson

## Teaching is more effective when it:

- **Builds on the knowledge learners already have**

This means developing formative assessment techniques and adapting our teaching to accommodate individual learning needs.

- **Exposes and discusses common misconceptions and other surprising phenomena**

Learning activities should expose current thinking, create 'tensions' by confronting learners with inconsistencies and surprises, and allow opportunities for resolution through discussion.

- **Uses higher-order questions**

Questioning is more effective when it promotes explanation, application and synthesis rather than mere recall.

- **Makes appropriate use of whole class interactive teaching, individual work and cooperative small group work.**

Collaborative group work is more effective after learners have been given an opportunity for individual reflection. Activities are more effective when they encourage critical, constructive discussion, rather than argumentation or uncritical acceptance. Shared goals and group accountability are important.

- **Encourages reasoning rather than 'answer getting'**

Often, learners are more concerned with what they have 'done' than with what they have learned. It is better to aim for depth than for superficial 'coverage'.

- **Uses rich, collaborative tasks**

The tasks we use should be accessible, extendable, encourage decision-making, promote discussion, encourage creativity, encourage 'what if' and 'what if not?' questions.

- **Creates connections between topics both within and beyond mathematics and with the real world**

Learners often find it difficult to generalise and transfer their learning to other topics and contexts. Related

concepts remain unconnected. Effective teachers build bridges between ideas.

- **Uses resources, including technology, in creative and appropriate ways**

ICT offers new ways to engage with mathematics. At its best it is dynamic and visual: relationships become more tangible. ICT can provide feedback on actions and enhance interactivity and learner autonomy. Through its connectivity, ICT offers the means to access and share resources and – even more powerfully – the means by which learners can share their ideas within and across classrooms.

- **Confronts difficulties rather than seeks to avoid or pre-empt them**

Effective teaching challenges learners and has high expectations of them. It does not seek to 'smooth the path' but creates realistic obstacles to be overcome. Confidence, persistence and learning are not attained through repeating successes, but by struggling with difficulties.

- **Develops mathematical language through communicative activities**

Mathematics is a language that enables us to describe and model situations, think logically, frame and sustain arguments and communicate ideas with precision. Learners do not know mathematics until they can 'speak' it. Effective teaching therefore focuses on the communicative aspects of mathematics by developing oral and written mathematical language.

- **Recognises both what has been learned and also how it has been learned**

What is to be learned cannot always be stated prior to the learning experience. After a learning event, however, it is important to reflect on the learning that has taken place, making this as explicit and memorable as possible. Effective teachers will also reflect on the ways in which learning has taken place, so that learners develop their own capacity to learn.

## Obstacles to progress

Participants identified many reasons for discrepancies between the current curriculum as implemented by schools and the curriculum we would wish to see. The most common reasons cited were:

- society's attitude towards mathematics
- the assessment should be defined by the curriculum aims, rather than a taught curriculum defined by assessment
- the style and quality of textbooks and other resources
- initiatives that appear conflicting, disempowering and prescriptive
- teachers' own subject and pedagogical subject knowledge.

**“provide convincing stories to demonstrate that learners can both learn more effectively through active engagement and pass exams.”**

Wright

## Suggested ways forward

Participants were also asked to suggest ways in which the above obstacles may be overcome. Their recommendations centred around four themes, namely:

- improve the provision and quality of professional development opportunities
- develop and share experience and resources for learning
- use professional standards to inform others about the teaching and learning of mathematics
- influence quality of key stage assessments and public examinations.

The NCETM will explore share all the underpinning evidence in the report with partners and stakeholders and will explore in greater depth the messages in the first three themes and use them to inform and influence its work.

To find out more about the NCETM and how it works to address these themes, go to [www.ncetm.org.uk/about](http://www.ncetm.org.uk/about)

## Lesson accounts

In the regional colloquia, we first asked participants to select and describe a mathematics lesson that had inspired them personally, and then to reflect on the values that this choice revealed. These accounts helped us 'flesh out' the general principles outlined above and we hope that they will be useful for teachers of mathematics for their continuing professional development (CPD).

In total, we received 57 lesson accounts, all of which have been checked and validated. (These have been added to the lesson accounts published in the first progress report.) They are easy to search and are categorised by the values that underpin the purpose of the lesson, the principles being demonstrated and the nature of the learner group.

We recommend that all those teaching mathematics take a look at these lesson accounts on the NCETM website at

**[nctm.org.uk/lessonaccounts](https://nctm.org.uk/lessonaccounts)**

**“ensure that continuous teacher learning is a professional requirement and entitlement for teachers of mathematics in all settings.”**

Hines, Periton, Hough

**“promote reflective practice so that teachers: Elicit, take note of, and respond to learner feedback; Develop practice in light of self-evaluation.”**

Ashley, Griffin, Griffiths, Houston, Lawrence

[www.ncetm.org.uk](http://www.ncetm.org.uk)

A Department for Children, Schools and Families initiative to enhance professional development across mathematics teaching.