

Inclusive teaching in mathematics

Introduction

Your vision for planning and teaching will apply to all classes and groups of pupils, and to each individual pupil. Only occasionally are the needs of individual pupils or groups of pupils so distinct that entirely different approaches are needed in order to help them learn mathematics and engage fully in lessons. In these instances, specialist guidance more detailed than that given in this short introduction will be needed.

In the main, you will adapt existing planning and teaching principles in order to include all pupils. This section responds to two considerations about planning and teaching mathematics:

- What is the best way to support the mathematical progress of pupils who have particular needs? For example, pupils learning English as an additional language or those with special educational needs, learning difficulties or disabilities.
- What are the most effective actions to take if any individual pupil or groups of pupils are not making expected progress?

In most cases the suggestions on the following pages involve adjusting existing practice rather than doing something new. For example:

- If you believe that pupils need to work together and to talk about their mathematics, the task is now to facilitate this collaboration more strategically for a pupil with emotional difficulties or a pupil who is not yet fluent in English.
- If you are working to develop a more open questioning style which allows pupils time to think, the task is now to choose questions so that pupils with misconceptions have them revealed and addressed.

The guidance that follows is based on strategies which have been tried and tested in the classroom. Each section includes references to further Strategy resources which will provide more background detail and more practical support.

You will notice that all entries in this section recommend keeping expectations high. Where expectations are high and teaching reflects this, most pupils, whatever their starting point, can aim for two levels of progress during Key Stage 3. For example:

- design lessons so that all pupils are included in ways that enhance their progress (see below)
- aim to keep an accurate picture of pupils' progress towards their targets (see 'Assessment and target-setting')
- when underperformance is identified, make a swift and strategic response (see Intervention in mathematics).

A fair 'rule of thumb' is to:

- know the pupils well
 - What can they already do mathematically?
 - What helps them learn effectively?
- know the mathematics well

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- What is needed to tackle the tasks?
- What connections can be made?
- What is this leading to?
- respond to the learning
 - How effective is the learning in these lessons?
 - Is the pace appropriate?

Pupils with English as an additional language (EAL)

EAL pupils may need support to develop language and to access the mathematics curriculum. It is easy to underestimate what pupils can do mathematically simply because they are new learners of English. Planning, teaching and learning for pupils learning EAL should be underpinned by the following key principles:

- Bilingualism is an asset and the first language has a continuing and significant role in identity, learning and the acquisition of additional languages.
- Cognitive challenge can and should be kept appropriately high through the provision of linguistic and contextual support.
- Language acquisition goes hand-in-hand with cognitive and academic development, with an inclusive curriculum as the context.

Planning for EAL learners is most effective when:

- it is part of the planning process of the whole department and is embedded in the usual planning format
- it takes account of the prior learning of the pupils, whether in the UK or abroad
- the role of additional adults with EAL expertise and/or bilingual or multilingual skills is clearly indicated and they are either involved in the planning process or have plans shared with them at the earliest opportunity
- contexts for learning are relevant, motivating and culturally inclusive
- it takes account of the language demands of the curriculum, including the use of subject-specific vocabulary where words have specific meanings in mathematics that are different from their ordinary use (e.g. mean, power, root) and grammatical complexities such as comparatives, conditionals and connectives
- it provides opportunities for speaking and listening, collaborative work and other strategies for language development
- consideration is given to the language of the task, how the pupils are grouped, and use of first language for learning.

Aim for EAL learners to hear good models of language from peers and adults as a regular feature of mathematics lessons. They are more likely to make progress in their learning when working alongside peers with similar cognitive ability and greater linguistic proficiency. Use cooperative small group work so that EAL pupils work collaboratively with more expert speakers of English as well as pupils who share their first language.

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Language learning styles vary and some pupils will not want to speak until they feel confident that they can produce an accurate and complete utterance. A silent period, where pupils are learning receptively by listening, is a natural stage that many early-stage learners of EAL go through. Adapt your questioning so that EAL learners feel included and are encouraged to contribute orally when they are ready to do so.

Acquisition of academic language will usually take considerably longer to develop than social language. Try not to compromise on the cognitive challenge in the mathematics and use bilingual approaches strategically; for example, pupils' understanding can be supported by exposing and discussing common misconceptions using the first language.

You will need to think carefully about how to build on the knowledge EAL pupils bring to a sequence of lessons. Encourage other pupils and teaching assistants to provide a listening focus by using additional props and prompts as they explain and discuss during lessons. Try to model this in your whole class work by using images and models, making appropriate use of ICT where possible. Offer further support by providing note-taking frameworks and pre-teach specific vocabulary.

When pupils arrive in school, their prior knowledge of mathematics must be assessed across a range of strands of mathematics and a range of levels. Assessments can use either English or a language with which the pupil is familiar. It is helpful if someone from the mathematics department is involved in the assessment. Bear in mind that some pupils will find questions set in context more difficult to interpret, so provide a range of question types. Assessment activities should be as practical as possible and be modelled for the pupil. The ease and confidence with which they approach or carry out the task from the cues given will be crucial elements affecting the judgment you reach. This is not a 'test'; it is Assessment for learning and should result in both teacher and pupil having a sense of what needs to happen next to support learning.

A culturally diverse cohort provides an opportunity for mathematics teaching and learning. The National Curriculum emphasises the importance of the history of mathematics and the mathematics of different cultures. Much of algebra and trigonometry owe their origins to Arab mathematicians. Pascal's triangle appears in Chinese mathematics some 300 years before Pascal was born. There are many games and puzzles from Africa, China and India which can be used to explore mathematical reasoning. Pupils will also bring a range of cultural perspectives and experiences to the classroom, which can be reflected in the curriculum and used to further the pupils' understanding of the importance of the issues of diversity. This also enables pupils' cultures to be valued. The 'Respect for all' website www.qca.org.uk/qca_6753.aspx provides examples of how the mathematics curriculum can be used to encourage pupils to value diversity and challenge racism.

'The nature and severity of the cognition and learning needs of pupils learning English as an additional language are easily underestimated or overestimated.

The identification and assessment of the special educational needs of children whose first language is not English requires particular care. It is necessary to consider the child within the context of their home, culture and community.'

SEN Code of Practice 2001 5.15

For further details and findings of research, see *Special educational needs and ethnicity: issues of over- and under-representation* at www.dfes.gov.uk/research/data/uploadfiles/RB757.pdf.

Further guidance is included in the *Secondary mathematics planning toolkit* (Pedagogy folder):

- *Literacy in mathematics*
- *Literacy and learning in mathematics*.

See also:

- *Access and engagement in mathematics*
- *Assessment toolkit to support pupils with English as an additional language.*

Pupils with special educational needs (SEN)

Special educational needs/learning difficulties and disabilities (SEN/LDD)

Approximately 20 per cent of the school population is defined as having special educational needs (SEN) and/or learning difficulties or disabilities (LDD).

Some of these pupils will also have learning difficulties linked to social deprivation and some pupils with special educational needs will also have disabilities. The learning difficulties encountered are often, but not always, associated with literacy and numeracy development and are sometimes aggravated by missed or interrupted schooling, perhaps due to long-term medical conditions.

In many cases, pupils' needs will be met through appropriate intervention (see 'Intervention in mathematics'), including the differentiation of tasks and materials. Rich tasks can be particularly useful in enabling access at different points for different pupils. You can ensure that pupils with SEN/LDD make good progress by:

- entitling all pupils to equal access to a full learning entitlement, whatever their starting point
- ensuring that there is high quality, differentiated assessment of individual need
- managing and liaising with additional adults
- planning lessons using the 'Waves model' for intervention and making use of the National Strategy progression maps to identify suitable curricular targets at class, group or individual levels (see 'Intervention in mathematics')
- ensuring that unit and lesson plans include a suitable range of objectives
- using a variety of teaching and learning styles
- using data to track pupils' progress against curricular targets (see 'Assessment and target setting')
- using a mix of whole class, small group, paired and individual work to allow the support and development of individuals' needs
- presenting information in a variety of forms – diagrams, models, verbal explanations and written explanations – to ensure accessibility
- providing structure for longer tasks; for example, through the use of speaking or recording frames.

A smaller number of pupils may need access to specialist equipment and approaches, or to alternative or adapted activities. There may be pupils in a class who need support in order to take part in whole-class work.

This support may take the form of:

- specific help with the recall of mathematical facts, to compensate for difficulties with long- or short-term memory
- help with the interpretation of data represented in graphs, tables or charts, to compensate for difficulties with visual discrimination
- access to tactile and other specialist equipment for work on shape, space and measures, to overcome difficulties with sight or in managing visual information
- help with interpreting or responding to oral directions, to compensate for difficulties with hearing or in auditory discrimination
- tasks designed to have smaller steps, which hold pupils into the content and pace of the lesson.

There will be occasions when it is also appropriate to seek advice and further support from the leadership team, other professionals, outreach from special schools and external specialists, as described in the SEN Code of Practice or, in exceptional circumstances, through a statement of special educational need.

In addition to the extensive support available through the intervention resources, there is now a selection of materials produced by the Strategy that can be used to support pupils with SEN:

- *Maximising progress – ensuring the attainment of pupils with SEN*
(www.standards.dfes.gov.uk/secondary/keystage3/all/respub/sen_inc)
- *Effective leadership: Ensuring the progress of pupils with SEN and/or disabilities*
(www.standards.dfes.gov.uk/secondary/keystage3/all/respub/sen_leadguide)
- *Towards the National Curriculum for mathematics*
(www.standards.dfes.gov.uk/primary/publications/mathematics/12802/).

In addition, some of the Strategy materials published initially to support Primary teaching and learning may also be useful:

- *Guidance to support pupils with dyslexia and dyscalculia*
(www.standards.dfes.gov.uk/primary/publications/mathematics/12812/)
- *Targeting support: Implementing interventions for children with significant difficulties in mathematics* (www.standards.dfes.gov.uk/primary/publications/inclusion/wave3_leaflet/)
- *Learning and teaching for dyslexic children*
(www.standards.dfes.gov.uk/primary/publications/inclusion/1170961/)
- *Mathematics and inclusion: Materials for providers of initial teacher training*
(www.standards.dfes.gov.uk/primary/publications/mathematics/itt_maths_and_inclusion/).

Pupils with disabilities

All schools are required to make 'reasonable adjustments' to enable pupils with physical difficulties to access the statutory curriculum. Support for most pupils with physical or sensory disabilities will generally take place in mainstream lessons as they work on the same mathematics programme as their peer group. Modifications to materials, equipment and furniture can help to meet the pupils' particular needs so that they can work alongside their peers. For

example, some pupils may need to use ICT to assist them in reading or recording their work. Pupils with hearing or visual impairments may need to be appropriately positioned in a class or helped to take part in an activity through signing or support by another adult.

Other adaptations which may be necessary include preparation for oral and mental work and the pace at which it is conducted, the use of signing, Braille and symbols, and the provision of materials that can be physically manipulated, including specific ICT aids and adapted measuring equipment.

Although pupils with disabilities often need time to become proficient with aids, expectations for them should remain high, with the focus on giving them maximum access and independence.

Pupils with emotional and behavioural difficulties

Many pupils with emotional and behavioural difficulties have poor literacy and numeracy skills as a result of their inability to maintain concentration and persevere with tasks. They can be supported by:

- ensuring that expectations are high, to prevent them becoming bored (e.g. not oversimplifying tasks)
- structuring lessons to maintain pace, giving opportunities for independent working and using a variety of activities
- using additional adults to help pupils begin tasks and to help them maintain concentration
- using praise to reward good learning behaviours (e.g. working effectively in groups)
- making mathematics relevant by relating it to the real world.

All pupils have an entitlement to the opportunity to develop emotional and social literacy but pupils with emotional and behavioural difficulties have an urgent need in this area. The Strategy's Social and Emotional Aspects of Learning (SEAL) Framework provides a rich source of guidance (see www.bandapilot.org.uk/secondary/).

Pupils with communication difficulties

Pupils with communication difficulties face particular challenges in mathematics. They need clear, effective teaching, which steadily builds their confidence and participation. Try to use a structured approach to the mathematical language required and frame its use by pupils. Some pupils with speech and language impairments have no other developmental difficulties and their mathematics lessons provide the opportunity to work alongside peers, practising and discovering strategies to overcome their difficulties.

Pupils who have autistic spectrum disorders, however, require well-structured lessons with clear routines and predictable parts. They respond best when the language used is concise, teaching is explicit, and challenges are direct and well focused. Try to ensure that your expectations are made crystal clear. Be explicit about what you expect the pupil to learn and exactly what you expect them to do. Explain this clearly for the lesson overall and then re-clarify for each separate part of the lesson or activity.

Pupils who are working well below national expectations for their age group

Where schools have significant numbers of pupils starting Key Stage 3 at level 3 or below in mathematics, it will be necessary to adapt the yearly teaching programmes more significantly. In

general this can be achieved by using those from the preceding year, adding adjustments as necessary to reflect areas of particular difficulty or relative strength. The Primary Framework for literacy and mathematics (www.standards.dfes.gov.uk/primaryframeworks/) provides guidance on progression from lower levels, although contexts may need to be adapted to reflect the older ages of secondary school learners. Maintain high expectations of progress and plan so that there is time for consolidation without sacrificing the breadth of the teaching programme or the principle of planning from clearly defined objectives.

For pupils working at level 3 and above, planning can be supported by the National Strategy progression maps which can help to identify areas of weakness, set curricular targets and identify resources to help pupils make progress (see 'Intervention in mathematics' and www.standards.dfes.gov.uk/intervention/).

Pupils who are very able at mathematics

The yearly teaching programmes in this Framework are targets for the majority of pupils in the year group. Able pupils deal with abstract mathematics more readily than do other pupils. They will progress more quickly through these programmes and will need extension and enrichment activities to develop the breadth of their mathematics and the depth of their thinking. They can be stretched by being given extra challenges and harder problems to do when other pupils are consolidating, by offering occasional differentiated group work, and by drawing work from the teaching programmes for older pupils. Homework also provides opportunities to set suitably challenging tasks.

Where numbers permit, able pupils frequently benefit from being able to work collaboratively with pupils of similar ability on challenging tasks. Where this is not possible, very able or gifted pupils who are markedly ahead of the rest of their class can follow individualised programmes at appropriate times, with far fewer practice examples and many more challenging problems to tackle, including work that draws on other subjects. Of course, they still need some teaching to ensure that they understand what they have read and know how to present their work.

Some capable pupils working ahead of age-related expectations can benefit from programmes which lead to early entry for GCSE, say in Year 10. But research indicates two important criteria for these to be successful in helping good mathematicians reach their potential. Firstly, the teaching and learning need to be appropriately stimulating and engaging to foster and maintain an enthusiasm for the subject. Secondly, there need to be clear and accessible routes beyond GCSE (e.g. through Year 11) which will ensure continued engagement with and progression in mathematics.

Details of provision for gifted pupils is available via the Young, gifted and talented website: www.ygt.dcsf.gov.uk.