

Numeracy across the curriculum

Notes for school-based training

Contents

Guide to the pack	Introduction	4
	Overview of the units	6
	Developing a programme: practical aspects	11
Unit 1	The importance of numeracy across the curriculum	17
Unit 2	A whole-school approach to numeracy across the curriculum	49
Unit 3	Mathematics through other subjects	71
Unit 4	Reviewing and sustaining a whole-school policy	103
Unit 5	The Framework for teaching mathematics and the approach to calculation	129
Unit 6	Using calculators in Key Stage 3	151
Unit 7	Handling data in Key Stage 3	177
Unit 8	Next steps: whole-school developments	211
Unit 9	Next steps: departmental developments	225
Appendix 1	Images of mathematicians and mathematics	239
Appendix 2	Vocabulary checklist	247
Appendix 3	Mathematics glossary for teachers in Key Stages 1 to 4	265

Guide to the pack

Introduction

This pack is designed to help you to plan and run training on numeracy across the curriculum matched to your school's particular needs. You should use the materials flexibly, tailoring training to the school's own priorities and stage of development. The pack supports schools that have already done considerable work on numeracy across the curriculum as well as those that are just starting. If you have a Key Stage 3 Strategy management group, then it ought to oversee this development.

In spring 2002 all schools are expected to devote a whole-school training day to numeracy across the curriculum. This day should be seen as part of an ongoing development and not an isolated event. The task of improving pupils' numeracy skills, and pupils developing and using these skills appropriately in other subjects, will not be achieved without sustained effort involving the whole school.

The overall intention is to foster cooperation and establish collaboration between departments. It is suggested that you identify cross-curricular activities for each of Years 7, 8 and 9, under three priority headings:

- to improve accuracy, particularly in calculation, measurement and graphical work;
- to improve interpretation and presentation of graphs, charts and diagrams;
- to improve reasoning and problem solving.

These priorities give a common focus and so encourage staff to work together to improve the numeracy skills of pupils. The improvement of these skills raises pupils' mathematical attainment, promotes high standards in other subjects, and has a profound effect on pupils' life chances beyond school.

It is important that the Key Stage 3 management group or senior management team discusses the school's priorities for the INSET day and agrees who will take responsibility for leading the planning of the day. In most schools, the head of mathematics or numeracy coordinator will probably direct the training, possibly with other members of the department acting as tutors for most of the units. In others the Key Stage 3 Strategy manager may wish to lead the training.

The following is a possible programme of action for those directing the training.

- Familiarise yourself with the section 'Mathematics across the curriculum' in the *Framework for teaching mathematics: Years 7, 8 and 9* (see section 1, pages 23–24).
- Discuss with colleagues pages 17–18 of the *Management guide: lessons from the pilot*.
- From these discussions you should establish:
 - the appropriateness of any existing policy on numeracy across the curriculum;
 - the extent to which this policy is embedded in practice;
 - examples of good practice within the school;
 - areas for development.

As a result of these discussions you should be able to identify the units that are most appropriate for the *designated training day* in your school and how these will fit into a *continuing programme of development*.

Special schools and units

In settings that are part of a mainstream school, special needs staff should take part in the whole-school training.

MLD/EBD schools and units are advised to use this training pack as any other school would. Select units appropriate to your needs. Some teachers may teach several subjects, which may help them to draw the links between mathematics and other subjects.

In PMLD/SLD schools, much of the planning for pupils is holistic rather than purely subject based. Links across the curriculum are therefore built in. This training pack itself will be of very limited use. However, in the materials for the three-day conference there are video sequences, made in a SLD/PMLD school, of a mathematics lesson and a follow-up PE lesson. You are encouraged to view these and think how you might adopt such an approach, and consider other ways in which you can link mathematics to other subjects.

Planning a programme

In planning a programme you need to consider what has been done in your school already. *It is important to consider the training units in this pack as part of an ongoing development, not just as a one-off training day.*

The overview below will help you to choose the most appropriate units for a training day. Other units can be used at a later date, either for whole-staff training or as the basis for individual departmental meetings.

What's in the training package

This folder contains the notes for each unit and three photocopiable appendices. Each unit starts with a list of objectives, suggestions for use, resources required and an overview of the session. After the detailed notes on running the session are photocopiable originals of the unit's OHTs and handouts.

The CD-ROM in the wallet includes:

- the OHTs in PowerPoint;
- the handouts and the leaflet *Numeracy across the curriculum objectives* as Microsoft Word and Adobe Acrobat pdf files.

Also contained in the wallet are:

- the video *Numeracy across the curriculum*;
- 10 copies of the leaflet *Numeracy across the curriculum objectives*;
- 10 copies of the poster 'Chocolate – the facts', for use in unit 7.

Overview of the units

Unit 1

75 minutes

The importance of numeracy across the curriculum

Objectives

- To consider the need to raise standards in numeracy
- To consider current images of mathematics and mathematicians
- To introduce the definition of numeracy
- To consider the need for improving numeracy skills across the curriculum

Suggested use

- All schools except those which have already established policies for numeracy across the curriculum; whole-staff meeting

It is best to start with this unit unless your school has already done considerable work on numeracy across the curriculum. In order to highlight the importance of numeracy across the curriculum, it is helpful if the headteacher or another member of the school senior management team introduces this unit.

Unit 2

75 minutes

A whole-school approach to numeracy across the curriculum

Objectives

- To consider one school's approach to numeracy across the curriculum
- To introduce activities to develop oral communication skills
- To discuss whether similar activities could be used in other subjects when mathematical skills are required
- To explore possible areas for inter-departmental cooperation in this type of activity

Suggested use

- All schools except those which have already established policies for numeracy across the curriculum; whole-staff meeting

This follows on from unit 1 and includes a case study of how one school has tackled numeracy across the curriculum. It goes on to consider how mathematics can contribute to pupils' oracy skills and how other subjects might make use of mathematical activities in some lessons.

Unit 3

75 minutes

Mathematics through other subjects

Objectives

- To discuss situations where the teaching of mathematics can be enhanced by using examples from other subjects
- To explore opportunities for collaborative planning and teaching of mathematical topics

Suggested use

- All schools except those which have already established policies for numeracy across the curriculum; whole-staff meeting or individual department meetings

If you are running a whole-school training day, this unit follows naturally from units 1 and 2. Staff work in departmental groups, supported as far as possible by a member of the mathematics department, to explore applications of mathematics within their subject areas. The outcomes of this session support the departmental follow-up session (unit 9).

Unit 4

75 minutes

Reviewing and sustaining a whole-school policy

Objectives

- To consider the need to raise standards in numeracy
- To review the school's existing practice in numeracy across the curriculum by:
 - comparing existing practice with a video of work in other schools
 - checking the requirements of the National Curriculum
 - discussing how best to sustain work already started

Suggested use

- Whole-staff meeting in schools with established practice in numeracy across the curriculum

If your school has already done a significant amount of work on numeracy across the curriculum, units 1 and 2 can be replaced by this unit. You may then wish to include parts of units 3 and 5 to form a double session.

Unit 5

75 minutes

The Framework for teaching mathematics and the approach to calculation

Objectives

- To introduce teachers to the *Framework for teaching mathematics: Years 7, 8 and 9*
- To exemplify oral and mental work in mathematics
- To consider the approach to calculation

Suggested use

- All schools; whole-school training day or staff meetings

This unit deals with the approach to calculation, and will be particularly useful for teachers of subjects that make use of calculation skills. Teachers work in subject groups to produce information that will support the departmental follow-up session (unit 9).

Unit 6

75 minutes

Using calculators in Key Stage 3

Objectives

- To review the use of calculators within departments
- To look at progression in calculator skills
- To explore the features of different types of calculators
- To contribute to a school policy on calculator use

Suggested use

- All schools; meetings of subject departments

This unit is aimed at departments where calculators are used. These departmental discussions might be best organised to build on the whole-school training units. It may be useful for a member of the mathematics department to work with departments on this unit. This may lead to more detailed discussions about the specific role of calculators within the work of the subject to provide information that will support the departmental follow-up session (unit 9).

Unit 7

75 minutes

Handling data in Key Stage 3

Objectives

- To become familiar with the approach to handling data in the *Framework for teaching mathematics: Years 7, 8 and 9*
- To explore possible opportunities for handling data across the curriculum
- To interpret graphs, charts and diagrams
- To consider common difficulties in handling data

Suggested use

- All schools; whole-school training day, staff meetings or individual department meetings

It may be useful for a member of the mathematics department to work with departments on this unit. It explores how work in other subjects can support mathematical skills and reasoning within the handling data cycle. It includes discussion of the appropriateness of different ways of representing data. Work from this unit will support the departmental follow-up session (unit 9).

Unit 8

45 minutes

Next steps: whole-school developments

Objectives

- To agree a set of whole-school numeracy priorities
- To discuss the need for a whole-school numeracy policy and its possible content
- To agree a plan of action to sustain developments

Suggested use

- All schools; whole staff

This unit is concerned with moving the school forward. It is intended to draw together the elements of the whole-school INSET day and other training. Following this unit there should be a clear school plan, including time deadlines, for writing or updating and subsequently implementing a whole-school numeracy policy.

Next steps: departmental developments**Objectives**

- To ensure that each department's expectations for pupils' mathematics are in line with those in the *Framework for teaching mathematics: Years 7, 8 and 9*
- To explore opportunities for continued joint working

Suggested use

- All schools; whole-staff meeting and departmental time supported by the mathematics department

This unit is designed to move each department forward and is best used when teachers of other subjects have deeper knowledge of the issues involved. They need to work with the mathematics department to ensure that the mathematics expectations of subjects are appropriate. The leaflet *Numeracy across the curriculum objectives* will help to support this task.

The video

The extracts on video are examples of how numeracy across the curriculum is developing in the schools that were filmed. The extracts are not intended as examples of 'perfect' teaching but have been chosen so that teachers can discuss them as part of their professional development. When watching the extracts, teachers will be expected to focus on particular aspects of numeracy across the curriculum.

Sequence	Unit	Duration	Title	Description
1	1	5 min	Consulting with the pupils	A group of pupils from Years 8, 9 and 10 discuss what mathematics they use in other subjects
2	2	12 min	Managing numeracy across the curriculum	Case study of a school where numeracy across the curriculum is already established
3a	3	13 min	Mathematics in geography	Linda teaches mathematics in a Year 8 geography lesson, following a field trip
3b	3	6 min	Mathematics in history	Martin uses pie charts to analyse a day in the life of a monk, with a Year 7 history class
3c	3	5 min	Mathematics in ICT	Melissa uses graphical representation to illustrate survey data, with a Year 7 ICT class

We are grateful to the teachers and pupils of the schools featured in the video extracts. They are:

School	LEA	No. on roll	FSM*
John Masefield School	Herefordshire	850	12%
Sandbach School	Cheshire	1050	8%

* Proportion of pupils eligible for free school meals

Developing a programme: practical aspects

What to do before the INSET day

Before starting training you are advised to:

- fix a date for a whole-staff meeting to prepare for an INSET day on numeracy across the curriculum;
- hold a mathematics department meeting to discuss how mathematics can link with other subjects (see unit 3, handout 3.7);
- consider how special needs support teachers, trainee teachers and teaching assistants will participate in the training;
- decide how the school will ensure that the ideas and practices discussed and planned during the INSET day will have a sustained impact upon standards and teaching in all subjects.

Planning a programme: two case studies

For most schools, units 1, 2, 3 and 8 would constitute a whole-school training day.

Unit 4 is designed to replace units 1 and 2 and parts of 3 for those schools that have already done a considerable amount of work on numeracy across the curriculum. It provides guidance on reviewing the school numeracy policy and an update on current issues.

All schools should ensure that appropriate staff are familiar with units 5, 6 and 7. Unit 5 provides a brief introduction to the *Framework for teaching mathematics: Years 7, 8 and 9*. Units 5 and 6 are particularly useful when working with departments who make use of calculation skills. Unit 7 deals with handling data.

Unit 8 builds on the other units with the aim of taking the *whole school* forward.

Unit 9 is essential to match mathematical expectations in *each subject* with those in the *Framework for teaching mathematics: Years 7, 8 and 9*, and is therefore recommended for *all* schools.

The following case studies illustrate some of the choices available to you.

Case study A

This school has done little work on numeracy across the curriculum. The headteacher has discussed the INSET day with the head of mathematics and the school's Key Stage 3 Strategy manager. They want to capture the key messages of numeracy across the curriculum and to begin the process of departments looking at their compatibility with the mathematics elements of the Strategy. They recognise that the implementation of numeracy across the curriculum will be a long-term development, taking perhaps one to two years.

Before the INSET day

- Meeting of mathematics department to discuss handout 3.7
- Meeting of SEN department to discuss handout 3.12

INSET day

- Unit 1 The importance of numeracy across the curriculum
- Unit 2 A whole-school approach to numeracy across the curriculum
- Unit 3 Mathematics through other subjects
- Unit 8 Next steps: whole-school developments

After the INSET day

- Staff meeting
Unit 5 The Framework for teaching mathematics and the approach to calculation
- Department meetings
Unit 7 Handling data in Key Stage 3
- Meetings of science, geography, PSHE, design and technology departments (supported by members of mathematics department)
Unit 6 Using calculators in Key Stage 3
- Staff meeting
Unit 9 Next steps: departmental developments to align subject needs with the expectations in the Framework
- Production of whole-school policy on numeracy across the curriculum

Case study B

This school has already done some work on numeracy across the curriculum:

- The mathematics department has tried to teach particular topics to fit in with other departments' schemes of work.
- Methods to be used in written calculations have been agreed.
- The school held an INSET day in 1999 on numeracy across the curriculum, and subsequently produced a whole-school policy.

The school's Key Stage 3 curriculum group discussed the whole-school INSET day. It was agreed that the head of mathematics would coordinate developments. The group decided to run two half-days of training, reflecting staff needs and enabling some departments to meet between the sessions.

Before the first INSET half-day

- Short input in staff meeting to introduce the issues and planned development
- Meeting of mathematics department to discuss handout 3.7
- Unit 4 Reviewing and sustaining a whole-school policy

INSET half-day 1

- Unit 5 The Framework for teaching mathematics and the approach to calculation
- Unit 7 Handling data in Key Stage 3

Between the half-days

- Meetings of science, geography, PSHE, design and technology departments (supported by members of mathematics department)
- Unit 6 Using calculators in Key Stage 3

INSET half-day 2

- Unit 3 Mathematics through other subjects
- Unit 8 Next steps: whole-school developments leading to adjustment of school policy on numeracy across the curriculum

After the two half-days

- Staff meeting
- Unit 9 Next steps: departmental developments to align subject needs with the expectations in the Framework

Evaluating the INSET day

As part of evaluating the long-term impact of the developments on numeracy across the curriculum, you will need to know how well the training day went, how useful colleagues found it, and what follow-up is required. You could use the evaluation form at the end of this section, inserting titles of your chosen units, or design one of your own.

Sustaining developments

In order to sustain the development of numeracy across the curriculum you might consider:

- keeping it as a priority in the school development plan and an item on some future heads of department meetings;
- evaluating it as part of the school's self-review;
- identifying a termly focus, such as mental calculations or using appropriate graphs, for staff training and departmental work;
- repeating (or doing) interviews with pupils after a term or two to see if they have noticed a difference;
- analysing pupils' performance, in other subjects, on examination questions that require some mathematical input;
- organising a mathematics week;
- revisiting numeracy across the curriculum as part of developments in other subjects;
- sharing developments with other schools, for example at meetings of heads of mathematics or of deputy heads.

Numeracy across the curriculum

Evaluation form

What were the most successful aspects of today's sessions?

How might the work on numeracy across the curriculum be followed up?

Please grade each session for usefulness and clarity.

<i>Session</i>	<i>Grade*</i>				<i>Comment</i>
	Very useful	←	→	Poor	
	1	2	3	4	
	1	2	3	4	
	1	2	3	4	
	1	2	3	4	
Overall grade for the day	1	2	3	4	

*Grade: 1 = very useful; 2 = useful; 3 = limited use; 4 = poor

