

key concepts

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SAGE

Key Concepts in
**Teaching Primary
Mathematics**



Cross-Curricular Mathematics

DEFINITION

Cross-curricular mathematics can be understood in three ways. First, other areas of the primary school curriculum can be seen as providing

opportunities to use and apply the skills and knowledge that pupils learn in mathematics lessons in purposeful activities. Second, other curriculum areas can be seen as providing meaningful contexts within which mathematical concepts can be introduced or developed. Third, mathematics can be seen as one of a number of curriculum areas that might come together in an extended cross-curricular project of some kind, which is not located in any particular subject area in the school timetable.

EXPLANATION AND DISCUSSION

The structure of the National Curriculum in England (DfEE, 1999a), in which mathematics is presented as one of a number of discrete subjects with its own programme of study, attainment targets and national tests, may suggest that mathematics and the other curriculum subjects are to be taught separately, within their own slots in the school timetable. The National Numeracy Strategy (DfEE, 1999b), with its insistence on a daily mathematics lesson (the 'numeracy hour') and its framework of objectives, yearly programmes and examples of pupils' achievements in mathematics, appeared to reinforce this perception. As a consequence, in the first few years of the current millennium an observer visiting primary schools in England may have been hard pressed to find any examples of teachers embracing cross-curricular approaches to mathematics.

This is not to say that the potential of cross-curricular mathematics was not recognized in these policy documents. The National Curriculum programme of study for Key Stage 2 (7 to 11 years) states that pupils should be taught the knowledge, skills and understanding in a number of ways, including 'using mathematics in their work in other subjects' (DfEE, 1999a: 74). However, there is no parallel statement for Key Stage 1 (5 to 7 years), where it might be expected that rigid divisions between subjects would be less appropriate. The Numeracy Strategy states that better numeracy standards occur 'when teachers make links 'between mathematics and other subjects' (DfEE, 1999b: 5). The framework contains the following advice to teachers.

Mathematics contributes to many subjects of the primary curriculum, often in practical ways. Activities such as recording the growth of a plant, measuring temperature and rainfall, or investigating the cogwheels in a bicycle can provide data or starting points for discussion in your mathematics lessons as well as opportunities to apply and use mathematics in real contexts. (DfEE, 1999b: 16)

Unfortunately these sentiments did not seem to be reinforced in the detail of the framework and its yearly programmes, so that when the Primary Strategy was reviewed, it was necessary to point out the following.

Within the curriculum, teachers and schools have the freedom to decide ... how to arrange learning in the school day. There is no requirement for subjects to be taught discretely – they can be grouped, or taught through projects – if strong enough links are created between subjects, pupils' knowledge and skills can be used across the whole curriculum. (DFES, 2003: following para. 2.39)

Significantly, the revised Primary Strategy in England now includes as one of its key principles: 'greater momentum in literacy and mathematics across the primary phase with increased flexibility to secure links across the curriculum' (DFES, 2006a: 1).

From the perspective of the mathematics educator, the importance of cross-curricular links involving mathematics has three aspects.

Using and applying mathematics in other subjects

Other curriculum areas can provide opportunities to serve the aim of using and applying mathematics and to do this through purposeful activities. Historically, much of the content of mathematics as a subject was developed to solve practical problems in science, economics, the social sciences, and other fields of human endeavour. The nature of the subject therefore makes it almost obligatory that in learning to use and apply mathematics – one of the key attainment targets in the curriculum – pupils at all stages should use their mathematical skills and knowledge in other subjects. This will almost certainly happen anyway, to some extent – it is difficult to do much science, for example, without using some mathematics – but there is perhaps a need for teachers to plan the application of mathematical skills and knowledge in a more deliberate way. For example, a primary teacher teaching a Year 6 class (10 to 11 years) how to calculate and use percentages could plan opportunities to use these skills in, say, whatever geography project or history topic is being taught concurrently.

Meaningful contexts for learning mathematics

Other curriculum areas can provide meaningful contexts within which to introduce and develop mathematical concepts and skills. New mathematical material does not have to be introduced in a mathematics lesson. Primary school teachers with responsibility for delivering most of the curriculum

to one class are uniquely placed to adopt a flexible approach to introducing new mathematical material that exploits the meaningful contexts of practical work across the curriculum. For example, the mathematics involved in timing events, measuring and recording time intervals, and using timing devices such as stopwatches or stop-clocks, could be taught entirely through activities with a high level of purposefulness within physical education and cookery lessons.

Cross-curricular projects

There is also some encouragement in current policy statements for primary teachers to adopt an even more flexible approach to delivering the curriculum, in which pupils engage in an extended project not linked to any particular curriculum subject, but drawing on all areas of the curriculum and developing creativity, generic thinking skills and problem-solving strategies. For example, pupils might tackle problems such as, 'How do we make the playground a better place for children?' or 'How can we improve lunch at school?' In such projects, mathematical skills are inevitably involved in realistic and relevant activity, and there is potential for pupils to see mathematics as something that can be used to 'make things happen' (Haylock et al., 1985).

PRACTICAL EXAMPLES

A further example of each of the first two aspects of cross-curricular mathematics discussed above is given below.

Applying number skills in physical education and English

A teacher in Key Stage 1 is planning to teach pupils to order a set of single-digit and 2-digit numbers and position them on a number line. Simultaneously, opportunities to use these skills are planned in other curriculum activities.

In a physical education lesson pupils will play a game that ends up with each member of each team of eight holding a card with a 2-digit number written on it: the winning team is the first team to line up with the numbers in order from smallest to largest.

In an English session looking at favourite story books, in the context of discussing whether children prefer long or short stories, each group of pupils will have the task of arranging a collection of popular story books in order, according to how many pages they have.

Learning data handling skills in other subjects

A teacher in Key Stage 2 decides that over the year everything that has to be taught about data handling can be done outside of mathematics lessons. Some practical work in science on measuring temperatures as substances cool will be used to teach pupils about line graphs; this will be reinforced in looking at the differing rates of growth of bean plants under various conditions. Frequency tables and bar charts will be taught in geography in surveys to be undertaken in a local study project; this material will be reinforced in a survey about favourite authors in English lessons and in collecting data from timing pupils in various activities in physical education. This data will also be used to introduce the concept of range as used in statistics.

FURTHER READING

Chapter 5 of Turner and McCullogh (2004) has plenty of practical suggestions for cross-curricular mathematics. Section 3 of the 1995 Yearbook of the US National Council of Teachers of Mathematics (NCTM, 1995) has a number of very relevant entries dealing specifically with connections across the elementary school curriculum.

RELATED ENTRY

Aims of mathematics teaching. Meaningful context. Purposeful activity. Using and applying mathematics.