

IMPROVING Mathematics

in Post-Primary Schools

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The Education and Training
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INVESTOR IN PEOPLE

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A number of quantitative terms are used in the report. In percentages, the terms correspond as follows:-

More than 90%	-	almost/nearly all
75%-90%	-	most
50%-74%	-	a majority
30%-49%	-	a significant minority
10%-29%	-	a minority
Less than 10%	-	very few/a small number.

INTRODUCTION

The findings in this paper are based on inspections of and visits to mathematics departments in post-primary schools in Northern Ireland during the period 1996-2000.

1. Strengths

- 1.1 In almost all schools, mathematics lessons are characterised by sound relationships, good levels of co-operation between teachers and pupils and diligent application by the pupils. In a significant minority of schools, the classroom ethos is distinguished by enthusiastic and challenging teaching in a supportive climate which encourages the pupils to think for themselves, ask questions and express their ideas; good outcomes are discernible in the pupils' enjoyment, interest and active engagement in learning.
- 1.2 In almost all schools, planning and teaching at key stages (KS) 3 and 4 reflect the knowledge and skills that comprise the content of the programme of study for Number, Algebra, Shape, space and measures, and Handling Data.

- 1.3 The main emphasis in the teaching is the development of the pupils' mathematical knowledge and skills and their use of standard methods for solving short and structured problems which, through experience, become relatively familiar to them. In a majority of schools, satisfactory or good standards of learning are achieved in these aspects of mathematics. The learning outcomes are best when the teaching promotes understanding of fundamental concepts, and competence in relevant techniques, and when it provides the pupils with regular opportunities to apply their mathematics to a range of problems in a variety of contexts.
- 1.4 In a significant minority of schools, the predominant strategy of direct teaching and practice exercises are integrated effectively with other approaches such as exploratory/investigative work, practical activities, the use of information and communications technology (ICT) and collaborative group activities. Where practical work has a clear learning purpose over and above the completion of the activity, and the teacher enhances the learning through discussion, it contributes well to developing the pupils' understanding.
- 1.5 Direct teaching is usually clear and well-focused; it is most effective when it is appropriately rigorous, integrated with other teaching and learning approaches and engages the pupils actively in mathematical thinking. This good teaching also ensures that the fluency in skills, routines and standard methods necessary for their confident application is kept fresh through application in a variety of contexts.
- 1.6 Most schools offering GCE A level mathematics provide a balanced choice of modules from pure mathematics, mechanics and statistics.
- 1.7 The quality of departmental leadership and management is satisfactory or better in a majority of the schools. In a minority of schools, both selective and non-selective, inadequacies in leadership are having adverse effects on teaching and learning.

2. Areas for Improvement

- 2.1 Collaborative learning is generally under-valued.
- 2.2 Those aspects of the programme of study which deal with learning experiences and contexts, language, and the educational themes are reflected inconsistently in planning and classroom practice.
- 2.3 In a majority of schools, the three strands of processes in mathematics are not developed systematically as a regular feature of classroom work. The pupils' experiences of processes are often confined to a few set-piece investigations in KS3 and GCSE coursework, much of which has become stereotyped.

- 2.4 Weaknesses in conceptual understanding and in standard procedures in number, algebra and other aspects of mathematics are found among minorities of pupils working at different levels, including GCE A level. The teachers' identification and analysis of the pupils' misconceptions are often not sufficiently thorough to inform the further teaching necessary to resolve the difficulties.
- 2.5 Most schools arrange smaller classes for pupils with learning difficulties and many allocate some additional teaching, mostly in the form of in-class support at KS3. The quality of provision is uneven; in a majority of schools, weaknesses in the progress of these pupils outweigh strengths.
- 2.6 In a small number of schools the proportion of pupils not entered for GCSE is indicative of expectations which are too low.
- 2.7 In a minority of lessons, there is insufficient emphasis on applications, a lack of variety in the activities chosen to reinforce essential aspects of learning, and insufficient account taken of the learning needs of individual pupils.
- 2.8 Teaching strategies, and the underlying planning, often need to be better informed by a clearer view of the different kinds of mathematical learning intended over a period of time, and used flexibly to respond to differences in the pupils' abilities, interests and prior learning, and in the ways in which individuals learn most effectively.
- 2.9 There is much variation in the attention given to mental work in number, and in the standards achieved. Schools in general need to provide more effectively for the systematic and progressive development of mental strategies, and mental imagery, in number and in other areas of mathematics as a vital part of their pupils' mathematical thinking and understanding.
- 2.10 In whole-class teaching, mathematical talk generally takes the form of brief answers by the pupils to closed questions by the teacher. Oral exchanges focus mostly on steps in the solution to a problem or on mistakes that have arisen. Less commonly, teachers build on their pupils' answers, exploit the learning potential of 'wrong' answers, or probe, check and extend the pupils' understanding, and encourage them to explain and justify their thinking and methods.
- 2.11 In only a minority of schools, teaching and learning are enhanced by the appropriate and effective use of a range of ICT tools, including graphics calculators. The potential of the calculator as a learning tool is under-exploited.

- 2.12 The teaching, at GCE A level, tends to be tightly focused on the demands of the examination in each module, with quite varying emphasis on developing the pupils' understanding of underlying concepts, extending their mathematical thinking and promoting an awareness of relationships between aspects of the subject.

3. Priorities for Action

To promote further improvement in the quality and standards of the pupils' learning in mathematics, schools should consider the extent to which they need to take action in their planning, teaching and assessment in relation to:

- 3.1 the quality of the pupils' mathematical understanding, thinking and reasoning, their ability to engage in mathematical enquiry, and to apply mathematics to a range of problems in a variety of contexts;
- 3.2 the progression in the pupils' mental mathematics and their ability to engage in mathematical discussion in order to demonstrate, explain and extend their understanding;
- 3.3 the development of the pupils' confidence in their mathematics and their ability to work with increasing autonomy;
- 3.4 the use of teaching strategies and resources, particularly ICT, to ensure that the pupils are provided with a variety of motivating experiences to achieve the necessary breadth and depth in mathematical learning, taking account of differences in the pupils' abilities and in the ways in which they learn most effectively;
- 3.5 helping the lower attaining pupils, in particular, to achieve a more secure understanding of their mathematics and to use, and retain, the skills and knowledge which they are acquiring.

CONCLUSION

Schools and the Inspectorate recognise the importance of self-evaluation as a basis for improvement and development. It is intended that this publication, and the publication 'Evaluating Mathematics', will support mathematics teachers and departments in their evaluation and improvement of their teaching and of their pupils' learning and standards of achievement.

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