

"DEVELOPING MATHEMATICAL THINKING"

By Ann Floyd

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This book comprises a selection of articles, some of which have been published elsewhere, and some for the first time in this publication. The major objective is to make explicit strategies for developing mathematical thinking in primary and post-primary schools. It attempts to achieve this in the first place by examining the nature of mathematical thinking itself which is seen largely as the type of thinking that is needed to solve unfamiliar mathematical problems. While recognition is given to the importance of computational skills as mathematical tools, the essential emphasis is on the acquisition of generalised methods of attacking mathematical problems not previously met.

This concern with problem solving is not a present-day phenomenon; educators over the past hundred years have expressed a similar concern and official statements over this period in the United Kingdom display a nagging unease about a perceived imbalance between pupils' ability to deal with computation on the one hand and problem-solving on the other. Recent investigations by the Drumcondra Research Centre and the Department of Education Inspectorate suggest that the problem is equally grave in this country.

The durability of this concern is well substantiated in the first section of this book which sets the problem in its historical setting quoting from H.M. Inspectorate's reports dating back to 1875, the Hadow Report (1931), the Plowden Report (1966), Biggs (1967), Primary Education in England (1978) et al. Readers will no doubt marvel at the self-assurance of the H.M.I. in 1876 who considered that mathematics "is a subject which seems to be beyond the comprehension

of the rural mind". Insights of this nature are not the exclusive prerogative of the Victorian mind. Readers will not be less impressed by the confident assertion of a contemporary author that "the reasons for teaching the standard written algorithms are out of date and that it is time we took note of this". However this book is "designed to evoke the critical understanding of students" and to this extent at least it should be successful. The first section on the book provides the student with a carefully selected compendium of extracts from the major reports on mathematics teaching and learning in the United Kingdom over the past fifty years. Most teachers and student teachers will find these articles absorbing reading, and some will be tempted to delve back into the original reports and a few may be tempted to engage in similar research in this country.

The second section introduces the reader to two major reports by H.M. Inspectors of Schools - Primary Education in England and Aspects of Secondary Education in England. These reports describe contemporary mathematics programmes and classroom procedures in English schools and provide interesting comments ranging from the efficacy of group teaching in the primary school to the dilemma of postprimary mathematics teachers attempting to meet the contradictory demands of a wide range of mathematics in newer schemes as against demands from local communities for concentration on a narrow range of traditional arithmetical skills. The dilemma will not be unknown to Irish teachers of mathematics. The final survey in this section (Mathematical Development, Foxman et al.) provides a national picture of pupils' mathematical capabilities.

Section three is concerned with the nature of mathematical thinking and strategies for developing it. Skemp's article on concept formation is of enduring interest. He holds that primary concepts are not acquired through analysing definitions but rather as a result of abstracting a general truth or law from a variety of experiences and observations. The

school curriculum must therefore provide adequate opportunity for active exploration so that the pupil will construct the mathematical rule before applying it. Such an approach is very much in the Piagetian tradition and is indeed the foundation stone on which the Irish Primary School Curriculum 1971 is built. This is not to say that Piaget is given unquestioning fealty in this reader. An article by E.R. Hughes describes a study of the order of acquisition of the concepts of weight, area and volume which casts serious doubts on some of the findings of Piaget.

Section four describes a wide range of activities designed to develop mathematical thinking. The merits of informal mathematical procedures are extolled and on the whole this emphasis is to be welcomed. But the reader may feel that the evidence suggests that we may build on the informal in order to construct the more economic formal algorithms rather than discard them altogether. The broad thrust of this section would appear to be a general denigration of the value of the traditional algorithms. Such an approach can be justified in the interest of evoking the "critical understanding of students". It is to be hoped, however, that the students will value the baby rather more than the bathwater.

Fielker's article on primary school geometry will be of considerable interest to primary and postprimary teachers wishing to think in a unified structural way about geometry rather than presenting pupils with an assortment of enjoyable but unrelated experiences of shapes.

The final section is concerned with the views of practising teachers who have tried to develop mathematical thinking in their classrooms using "do, talk and record" approaches. Practical considerations such as grouping within classes, pupil discussions, the creation of classroom atmosphere, the development of a consistent school policy etc. are discussed in the light of teachers' experience at primary and postprimary level.

This volume must surely be regarded as essential reading for students in education departments in Universities and Colleges of Education. It immerses the student in the major contemporary problems facing teachers of mathematics at primary and junior cycle postprimary levels. It will also be invaluable for many mathematics teachers' study groups interested in identifying, investigating and researching problems in mathematics teaching and contributing towards the development of better mathematics curricula. Finally it should help to minimize the feeling of isolation experienced by many mathematics teachers striving to enthuse their students with an awareness of the order, unity and beauty of mathematics.

*Kevin McDonagh,
Department of Education,
Our Lady of Mary College,
Carysfort Park,
Blackrock,
Co. Dublin.*