

INTRODUCTION

The goal of the activities in this book is to develop understanding and insight of the patterns of mathematics through the use of concrete materials. The activities are designed to help young children see relationships and interconnections in mathematics and to enable them to deal flexibly with mathematical ideas and concepts.

A page of abstract symbols, no matter how carefully designed or simplified, *because of its very nature*, cannot involve the child's senses the way real materials can. Symbols are not *the concept*, they are only a representation of the concept, and as such are abstractions describing something which is not visible to the child. Real materials, on the other hand, can be manipulated to illustrate the concept concretely, and can be experienced visually by the child.

A variety of familiar materials gathered from the child's world enable a teacher to begin where the child is, in *his or her* world, and with them, to gradually build a bridge to the adult world of abstraction. Because the materials are real, and physically present before the child, they engage the child's senses, and are, *in themselves*, enjoyable and rewarding. The materials provide motivation for learning at the same time that they provide the tools for exploration and problem solving.

During the beginning stages of concept development, abstract symbolization tends to interfere rather than enhance the understanding of a concept. For this reason, a great deal of this book deals with ideas that develop concepts without the use of any written numerals. Abstract symbolization is only used to label a concept which the child *already grasps*, never as a "material" from which the child is taught a concept. The emphasis throughout this book is making *concepts*, rather than numerical symbols, meaningful.

Each chapter is a building block for succeeding chapters. For example, the ideas in Chapter 5 build upon the ideas from earlier chapters and prepare the child for ideas in all subsequent chapters. The concepts are very simple, but they are interrelated and support one another to increase the development of the child's mathematical understanding.

All teachers, whether working with preschool or second grade, follow the sequence of activities as outlined in the chapters. Preschoolers or kindergarteners will not progress as far or as quickly as first or second graders. Second graders will be able to go into more depth with a more complex focus than

will kindergarteners or first graders. A guide in the appendix assists teachers of various grade levels in planning their mathematics program.

The opening page of each chapter lists the chapter's mathematical skills and concepts, the self concept and social interaction skills, future application of the chapter, and the chapter's prerequisites. The activities in the body of the chapter are divided into two sections: *The introduction of the concept* and *the application and extension of the concept*.

The Introduction is comprised of several total-group activities which are designed to surround the child with the new concept in a variety of forms. The Application and Extension section suggests experiences which will enable small groups of children to apply and extend the concept presented in the introduction. Each activity includes a list of the specific skills taught and the materials needed, as well as a description of the activity itself.

Through the activities in Chapter 1 (Free Exploration) children have an opportunity to explore new materials in their own way. They may count particular objects, sort them, compare the sizes or shapes, or make designs. No one evaluates their explorations or suggests they "should" be exploring other ideas; they are completely free to organize their exploration in their own way and spend whatever time they choose with each material.

In Chapter 2 (Pattern One) children are introduced to linear and geometric patterns. Through a variety of activities they learn how to arrange a design so that it repeats itself over and over in a predictable way. This chapter is the first awakening in the child of the concept that will, when fully developed, lead the child to see the beauty and structure of abstract mathematical patterns.

The activities in Chapter 3 (Sorting and Classifying) help the children organize objects according to their properties or attributes. These activities develop logical thinking and language skills, as children notice and describe small details in the materials they are sorting and classifying. Logical thinking is the language of mathematics.

Chapter 4 (Counting) gives the children an opportunity to develop skill with the counting sequence. Through these activities children acquire skill in counting forward and backward and reinforce the skills of invariance and counting on. These skills prepare the children for number concepts in all the later chapters.

Chapter 5 (Comparing) develops the concept of more, less, and the same. Through these activities the children make comparisons of length, quantity, weight, volume, and duration. An understanding of these comparisons provides an important foundation which helps children fully understand the relationship between one number and another at the concrete and abstract levels.

Through the activities in Chapter 6 (Graphing) the children extend their comparing skills and solve the problem of, "How *many* more?" through visual comparisons of objects in a variety of graphs. These activities provide children with daily problem-solving situations.

In Chapter 7 (Number at the Concept Level) the children explore each number from one to ten through a variety of activities, discovering the possible arrangements and combinations for each number. These experiences help each child gain a real understanding of the quantities from one to ten. Written symbols can interfere with the development of these concepts and, consequently, are not yet introduced.

Chapter 8 (Number at the Connecting Level) introduces children to the traditional mathematical symbolization which they now are ready to use to label their work. Children are not yet required to write the symbols, but rather, are merely gaining familiarity with the meaning of the symbols by decoding them as they match the symbols to familiar quantities and processes.

Chapter 9 (Number at the Symbolic Level) requires children to write the traditional mathematical symbolization to record a variety of mathematical experiences. The concept of the numbers from one to ten are now fully developed and symbolized abstractly.

Chapter 10 (Pattern Two) extends the children's experience with patterns and prepares them for the number patterns they will discover when using place value.

Chapter 11 (Place Value) presents a sequence of activities which allows the children to explore and discover the structure of our number system. A variety of ways of grouping are explored and the children discover the patterns produced by varying the grouping. These activities lead the child to an understanding of base ten and the patterns on which mathematics is based.

Chapter 12 (Pattern Book Experiments) draws on all the skills in the previous chapters and presents many experiments

which enable the children to look for patterns in base ten as they apply their understanding of place value.

In the appendix you will find the following: a Glossary of Materials, a description of How To Use MATHEMATICS *THEIR WAY* at Various Grade Levels, a Guide to Facilitate Classroom Planning, a Guide to Black-Line Masters, which are bound separately, and Sample Letters to Parents.

The Glossary of Materials contains pictures and definitions of the materials coded with an asterisk in the text. The sources of commercial materials are given and the quantity of each material needed is listed. Directions for constructing teacher-made materials are also given.

The description of How to Use MATHEMATICS *THEIR WAY* at Various Grade Levels outlines the sequence of activities and number of weeks or months a typical class might spend on each chapter's activities.

The Guide to Facilitate Classroom Planning relates the concepts and activities in various chapters into a workable classroom scheme.

The Guide to Blackline Masters explains how to use and prepare the Worksheets (Masters 1–61), Observation Sheets (Masters I–IX), and the Assessment of Skills (Masters A1–A16).

The Sample Letters to Parents are suggestions of letters which should be sent to parents throughout the year to explain the concepts the children are working with and to involve the parents in related home experiences.

The Resources include teacher and classroom resources. The children's literature listed in this section includes topics and titles not on the chapter bookmarks.

The Index provides references to both *Mathematics Their Way* and the *Mathematics Their Way Summary Newsletter*.

The chapter bookmarks provide an easy reference to coordinate *Mathematics Their Way* with the *Summary Newsletter*. They also contain references to children's literature and other classroom resources. Additional children's books are listed with the resources (pages 399–405). The bookmarks can be used with the chapters and stored in the plastic sleeve at the end of the book.