

# CHAPTER 1

## Overview of Mathematics...A Way of Thinking

This is a book about teaching mathematics to children.

Several beliefs underlie the philosophy and approach of this book. (1) Computational skills are more easily learned when drawn from concrete experiences. (2) The key element in learning mathematics is logical thinking, which, in turn, involves the ability to recognize patterns. (3) Students learn best in an environment free of the fear of failure. (4) Students try hardest when the efforts of each have the potential of being valued equally. (5) The hand calculator, one of the most beneficial educational tools technology has provided, will not make obsolete the learning of arithmetic. (6) Differing levels of ability can be encompassed within a single framework of content. (7) The slow learner should be included as an active and equal participant in the total program.

### TARGET AUDIENCE

Teachers of students in grades three through six comprise the target audience for this book. Although the ideas presented have been proven successful in classrooms representing a wide variety of socio-economic backgrounds, the activities were originally developed and tested in both Title I schools (schools with a large percentage of under-achieving students) and in classrooms for educationally handicapped students or into which they were being mainstreamed.

The lessons are designed to provide challenging activities for *all* students in a class, regardless of their range of academic achievement. Each lesson's activities are a product of successful teaching experiences in classrooms where the tested grade levels of students at the beginning of the year have ranged from 1.0 to 7.0.

### USING THE LESSONS

Each chapter provides a sequence of related lessons covering a specific topic, such as advanced multiplication, or probability. Each lesson is an activity-centered learning experience designed to provide students with the mathematical and social skills that will enable them to handle problem-solving situations.

Each lesson is presented in a step-by-step manner, with suggested dialog that might occur between teacher and students, plus additional commentary about the presentation that should aid the teacher in conducting the lesson. Illustrations appear in the lesson at the time when they will be used by teacher or student. In other words, each lesson is in a sense a script, programing the teacher along a specific path.

This may seem unduly prescriptive. So keep in mind that the intent is to make the initial job easier by having a model for reference. Of course, the ultimate goal is for each teacher to present the content in his or her own words.

Although the lessons within each chapter represent a closely related sequence of activities, the chapters themselves are not as closely interwoven. Those few having as prerequisites previous chapters include this information on the accompanying materials list. The chapters may be grouped or separated to augment or supplement a teacher's present mathematics curriculum. Together, the chapters may also be used as a total mathematics curriculum. Suggested methods of interrelating chapters into continuums or curriculums are included in Chapter 24, Integrated Lesson Chart.

In the first year of using this book, the teacher is not expected to present all the ideas to students. It is more likely that the teacher would test selected ideas. As the ideas prove their value and the teacher gains experience in presenting them, additional suggestions from the book may be tried. How many chapters to present, which ones, and how soon is a decision only the teacher can make.

The teacher must also decide how much time to spend on each lesson. If students become engrossed in a particular lesson they should be allowed to pursue it until their curiosity is satisfied. If they need more time to understand the basic ideas they should be allowed more than one day to absorb the lesson. If, on the other hand, students catch on quickly to what is expected and rapidly complete the activities, the next lesson in the sequence should be presented, even if two or more lessons are covered in a single day. The important point is that students learn well what each lesson has to offer.

The activities within each chapter are designed to teach a specific concept or group of concepts. The concept to be taught is the same regardless of the grade level at which it is presented. Consequently, the teacher, regardless of grade level, starts students with the *beginning* activities in each chapter selected. The students themselves are the measure of how much can be covered and at what pace. A third grade class may, for example, linger longer over the activities in beginning addition than might a sixth grade class. There may be sixth grade classes, however which spend longer on beginning addition than would some third grade classes. Both the activities selected for coverage and the rate at which these activities are covered are functions of the students themselves. The teacher observes these needs, selects the lessons, and adjusts their flow accordingly.

Included in the Appendix is a system for keeping track of the topics chosen so teachers in a following year have a record of each student's progress.

### MATHEMATICAL CONTENT

Half the lessons in this book relate to the subsection of mathematics known as arithmetic. Learning to understand

arithmetic is the primary concern in an elementary mathematics curriculum. The second half of the lessons center around areas of mathematics that are not arithmetic. These include applications, problem solving, geometry, measurement, probability, statistics, relationships, functions, logical thinking, patterns, and a great deal more. Study of these provides students with a wide variety of problem-solving skills which they may use to make better sense of their world. Studying more areas of mathematics also allows students an opportunity to use their growing arithmetic skill as a problem-solving tool.

If students see a need for arithmetic skills they will internalize these skills more quickly; the study of mathematics provides this need.

Arithmetic is numbers. Mathematics is a way of thinking. This is a book about teaching mathematics to children.

## CLASSROOM MANAGEMENT

Two questions often occur to teachers when presented with systems of instruction calling for the use of manipula-

tive materials in a class of 30 or so students. First, how do I keep my students from misusing (throwing) the materials? Second, how do I convince my students materials are not "baby stuff"?

Readers with questions such as these might find it helpful to read Chapter 22, The Classroom, and the introduction to Chapter 23, Materials before reading Chapter 2, which begins the lessons.

The purpose of this book is to provide a detailed guide for teachers wishing to implement an activity-centered approach to the teaching of mathematics. The book may be used as a complete mathematics curriculum by teachers seeking an alternative to textbooks. It may also be used as a resource by teachers wishing to supplement textbook lessons with manipulative activities.

Whichever way the book is used, the measure of its worth is its ability to assist teachers in making learning both meaningful and enjoyable for their students. This measure is best made as teacher and students together share the explorations and discoveries in the lessons which follow.