

The background of the cover features several stylized, light green leaf motifs scattered across a yellow-to-white gradient. These motifs are simple line drawings of leaves on stems, appearing in various orientations.

GUIDE TO MATH MATERIALS

Resources to Support the NCTM Standards

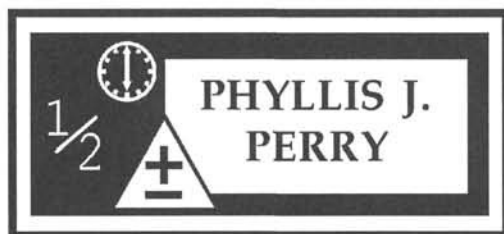
Phyllis J. Perry

Guide to Math Materials

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*Dedicated to
Kimberly Tabor for all of her wonderful
support and advice.*



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INTRODUCTION

There have been many calls for reform in the teaching of mathematics, both at the national and local levels. America 2000 and Goals 2000, for example, are national efforts that have called for our students to be “first in the world” in math and science by the year 2000. Boards of education in school districts across the country continually hear requests for “higher academic standards,” particularly in the areas of reading, writing, science, and mathematics.

Much of this concern arises because America is increasingly becoming an information society. Calculators, computers, and other technology have greatly affected our way of life. Although it sounds contradictory, technology has made things both easier and more complex for students, teachers, and parents.

Against this background of reform and concern about academic achievement, a dramatic change in the curriculum for the teaching of mathematics has come about since the mid-1980s. Several work groups in the National Council of Teachers of Mathematics (NCTM) addressed this issue,¹ noting that children enter kindergarten with some mathematical experience and understanding and that this understanding deepens if the students are provided with a *developmentally appropriate* curriculum. Such a curriculum encourages exploration and curiosity and allows children time to develop their abilities to solve problems, reason, find connections, and communicate about mathematics.

The work groups further recognized that the mathematics curriculum in kindergarten through fourth grade is vitally important because it establishes the foundation for success at higher grade levels. While it is true that children need to acquire mathematical skills during this time, there is also a qualitative dimension to their learning. How well children come to understand mathematical concepts in the primary grades is very significant, since the beliefs and attitudes about mathematics formed during these years influence a student’s thinking, performance, and decisions about further studies of mathematics.

Six basic assumptions were made by the NCTM work groups that governed the selection of the curriculum standards. According to these assumptions the K-4 curriculum should

- 1) be conceptually oriented,
- 2) actively involve children in doing mathematics,
- 3) emphasize the development of children’s mathematical thinking and reasoning abilities,
- 4) emphasize the application of mathematics,
- 5) include a broad range of content,
- 6) make appropriate and ongoing use of calculators and computers.²

As a result of this work, there are at present 13 curriculum standards for mathematics. Even though these standards are a recent development of work completed since 1986 when the Board of Directors of the National Council of Teachers of Mathematics established the Commission on Standards for School Mathematics, they are not set in stone. In fact, there is already discussion of modifying these standards. Some states have even collapsed the original 13 standards into a smaller number of standards.

Even if the number of standards does change in the coming years, the conceptual framework of the original 13 standards will still provide a strong basis for parents and teachers to consider as they plan mathematical experiences for elementary-aged students. They provide the framework for this book, *Guide to Math Materials*.

This book has two purposes. First, it reinforces the outstanding work done by the National Council of Teachers of Mathematics (NCTM) in developing curriculum standards for students in kindergarten through fourth grade by discussing the 13 strands of mathematics and their implications for teachers and parents who work with children.

Second, it provides some suggested resources within each of these 13 curricular strands that will assist teachers and parents in helping students to enjoy math and to increase their mathematical understandings.

The lists of resources are extensive but by no means exhaustive. They do indicate the range of materials available to parents and teachers. Faced with so many options to choose from, a busy teacher may feel dismayed. Opinions on which products to use are certainly subjective, and only the classroom teacher can make the wisest selection of materials needed for his or her students. To make this list easier to use, the author has marked some items with asterisks (**) to indicate that they are exceptionally good values. For those teachers on a limited budget or who can purchase only a few items, these are the items to buy. Books, manipulatives, games, kits, computer programs, videos, and other items have been included. Computer programs and videos are also marked with special symbols to assist those teachers looking for materials in these newer technologies.

Materials listed in this book are intended to assist teachers and parents of students in kindergarten through fourth grade. Some advanced materials are also included for those teachers who need to challenge fourth-grade students working at a higher academic level.

Each resource has been listed only once, even though many of the materials lend themselves to multiple uses. The author has placed a particular resource in a specific strand knowing that creative teachers and parents may find multiple uses for the same resource and may find it equally valuable or even more valuable in teaching other strands.

Some manipulatives, such as geoboards, tangrams, pattern blocks, and clock faces, are so popular that there simply was not space to list every company that supplies them. When readers need basic, popular items, they should check with a favorite and convenient supplier to see if similar items are available. Prices vary considerably, and the reader may want to check several sources and consider quantity buying to maximize purchasing power.

In some cases, such as with kits containing a variety of manipulatives, the resource was clearly designed to be used across the NCTM standards. To avoid duplication of information, such resources were listed only once, in chapter 14, rather than being included in each chapter.

It should be noted that this book is intended for use as a buyer's guide and not necessarily as a bibliography. This book, therefore, provides information on distributors of books and other items to assist readers who wish to obtain the various items.

Finally, while the author attended conferences and materials exhibits, visited classrooms to observe math lessons in progress and the materials being used, ordered and studied catalogs, and made every effort to be thorough, some excellent math materials were no doubt overlooked. A sufficient number of resources have been included in every standard, however, so that parents and teachers should have a good idea of the variety of materials available.

Following are the 13 standards as published by the National Council of Teachers of Mathematics in the *Curriculum and Evaluation Standards for School Mathematics*, in March 1989.

STANDARD 1: MATHEMATICS AS PROBLEM SOLVING

In grades K-4, the study of mathematics should emphasize problem solving so that students can:

- use problem-solving approaches to investigate and understand mathematical content;
- formulate problems from everyday mathematical situations;
- develop and apply strategies to solve a wide variety of problems;
- verify and interpret results with respect to the original problem;
- acquire confidence in using mathematics meaningfully.

STANDARD 2: MATHEMATICS AS COMMUNICATION

In grades K-4, the study of mathematics should include numerous opportunities for communication so that students can:

- relate physical materials, pictures, and diagrams to mathematical ideas;
- reflect on and clarify their thinking about mathematical ideas and situations;
- relate their everyday language to mathematical language and symbols;
- realize that representing, discussing, reading, writing, and listening to mathematics are a vital part of learning and using mathematics.

STANDARD 3: MATHEMATICS AS REASONING

In grades K-4, the study of mathematics should emphasize reasoning so that students can:

- draw logical conclusions about mathematics;
- use models, known facts, properties, and relationships to explain their thinking;
- justify their answers and solution processes;

- use patterns and relationships to analyze mathematical situations;
- believe that mathematics makes sense.

STANDARD 4: MATHEMATICAL CONNECTIONS

In grades K-4, the study of mathematics should include opportunities to make connections so that students can:

- link conceptual and procedural knowledge;
- relate various representations of concepts or procedures to one another;
- recognize relationships among different topics in mathematics;
- use mathematics in other curriculum areas;
- use mathematics in their daily lives.

STANDARD 5: ESTIMATION

In grades K-4, the curriculum should include estimation so students can:

- explore estimation strategies;
- recognize when an estimate is appropriate;
- determine the reasonableness of results;
- apply estimation in working with quantities, measurements, computation, and problem solving.

STANDARD 6: NUMBER SENSE AND NUMERATION

In grades K-4, the curriculum should include whole number concepts and skills so that students can:

- construct number meanings through real-world experiences and the use of physical materials;
- understand our numeration system by relating counting, grouping, and place-value concepts;
- develop number sense;
- interpret the multiple uses of numbers encountered in the real world.

STANDARD 7: CONCEPTS OF WHOLE NUMBER OPERATIONS

In grades K-4, the mathematics curriculum should include concepts of addition, subtraction, multiplication, and division of whole numbers so that students can:

- develop meaning for the operations by modeling and discussing a rich variety of problem situations;
- relate the mathematical language and symbolism of operations to problem situations and informal language;
- recognize that a wide variety of problem structures can be represented by a single operation;
- develop operation sense.

STANDARD 8: WHOLE NUMBER COMPUTATION

In grades K-4, the mathematics curriculum should develop whole number computation so that students can:

- model, explain, and develop reasonable proficiency with basic facts and algorithms;
- use a variety of mental computation and estimation techniques;
- use calculators in appropriate computational situations;
- select and use computation techniques appropriate to specific problems and determine whether the results are reasonable.

STANDARD 9: GEOMETRY AND SPATIAL SENSE

In grades K-4, the mathematics curriculum should include two- and three-dimensional geometry so that students can:

- describe, model, draw, and classify shapes;
- investigate and predict the results of combining, subdividing, and changing shapes;
- develop spatial sense;
- relate geometric ideas to number and measurement ideas;
- recognize and appreciate geometry in their world.

STANDARD 10: MEASUREMENT

In grades K-4, the mathematics curriculum should include measurement so that students can:

- understand the attributes of length, capacity, weight, mass, area, volume, time, temperature, and angle;
- develop the process of measuring and concepts related to units of measurement;
- make and use estimates of measurement;
- make and use measurements in problem and everyday situations.

STANDARD 11: STATISTICS AND PROBABILITY

In grades K-4, the mathematics curriculum should include experiences with data analysis and probability so that students can:

- collect, organize, and describe data;
- construct, read, and interpret displays of data;
- formulate and solve problems that involve collecting and analyzing data;
- explore concepts of chance.

STANDARD 12: FRACTIONS AND DECIMALS

In grades K-4, the mathematics curriculum should include fractions and decimals so that students can:

- develop concepts of fractions, mixed numbers, and decimals;
- develop number sense for fractions and decimals;
- use models to relate fractions to decimals and to find equivalent fractions;
- use models to explore operations on fractions and decimals;
- apply fractions and decimals to problem situations.

STANDARD 13: PATTERNS AND RELATIONSHIPS

In grades K-4, the mathematics curriculum should include the study of patterns and relationships so that students can:

- recognize, describe, extend, and create a wide variety of patterns;
- represent and describe mathematical relationships;
- explore the use of variables and open sentences to express relationships.

A chapter of this book has been devoted to each of these standards. Each chapter includes a brief discussion, followed by a list of resources to help students grasp the appropriate concepts.

Assessment is not addressed in this book. Readers interested in this topic should consult the National Council of Teachers of Mathematics book *Assessment Standards for School Mathematics*, available for purchase from NCTM's offices at 1906 Association Drive, Reston, VA 22091-1593. It details the standards needed for an effective assessment system, the different purposes of assessment, and the issues, conditions, and challenges associated with changing to a new assessment system.

NOTES

1. *Curriculum and Evaluation Standards for School Mathematics* (Reston, Va.: National Council of Teachers of Mathematics, 1989) p. 16.
2. *Curriculum and Evaluation Standards for School Mathematics* (Reston, Va.: National Council of Teachers of Mathematics, 1989) pp. 17-19.

RESOURCES

Addresses of publishers or suppliers are listed in chapter 15.

Books

- **** Apelman, Maja, and Julie King. **Exploring Everyday Math: Ideas for Students, Teachers, and Parents.** Portsmouth, N.H.: Heinemann, 1993. 219p.
- Atkinson, Sue, ed. **Mathematics with Reason.** Portsmouth, N.H.: Heinemann, 1992. 176p.
- Baker, Ann, and Johnny Baker. **Mathematics in Process.** Portsmouth, N.H.: Heinemann, 1990. 170p.
- McKeown, Ross. **Learning Mathematics: A Program for Classroom Teachers.** Portsmouth, N.H.: Heinemann, 1990. 139p.
- Ohanian, Susan. **Garbage Pizza, Patchwork Quilts, and Math Magic.** New York: W. H. Freeman and Company, 1992. 256p.
- Parker, Ruth E. **Mathematical Power: Lessons from a Classroom.** Portsmouth, N.H.: Heinemann, 1993. 229p.
- **** Schifter, Deborah, and Catherine Fosnot. **Reconstructing Mathematics Education.** New York: Teachers College Press, 1992. 256p. Available from Math Learning Center.
- Stoessiger, Rex, and Joy Edmunds. **Natural Learning and Mathematics.** Portsmouth, N.H.: Heinemann, 1992. 113p.
- Van de Walle, John A. **Elementary School Mathematics: Teaching Developmentally.** 2d ed. White Plains, N.Y.: Longman, 1994. 544p.
- Whitin, David J., H. Mills, and T. O'Keefe. **Living and Learning Mathematics: Stories and Strategies for Supporting Mathematical Literacy.** Portsmouth, N.H.: Heinemann, 1991. 176p.

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