Preface

Skill in the critical reading of data, which is a component of quantitative literacy, is a necessity in our highly technological society. In particular, processing information presented on the Internet, on television, and in newspapers, magazines, and commercial reports is dependent on a reader's ability to comprehend graphs.

To meet the needs of society, industry, and business, our students must become adept at processing information. With the publication of *Curriculum and Evaluation Standards for School Mathematics,* the National Council of Teachers of Mathematics (NCTM) advocated that children be involved in collecting, organizing, and describing data. Furthermore, it recommended that children construct, read, and interpret graphs as well as analyze trends and predict from the data (NCTM 1989, pp. 54, 109). This position has been reaffirmed in *Principles and Standards for School Mathematics* (NCTM 2000).

This book, a revised and expanded edition of *Developing Data-Graph Comprehension: Elementary and Middle School Activities* (Curcio 1989, 2001), is intended to provide elementary and middle school teachers and teacher educators with practical ideas on incorporating the graph-reading component of quantitative literacy into the instructional program. It can be used to supplement the teachers' editions of grades K–8 textbooks or as an elementary methods text for preservice and in-service teachers. It provides many suggestions for activities that can be used with youngsters in both small-group and large-group instruction. In support of *Principles and Standards for School Mathematics* and *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics* (NCTM 2006), the activities presented in this book provide teachers with ideas to emphasize exploration, investigation, reasoning, and communication in mathematics. Furthermore, suggestions for integrating technology as a graphing tool are presented in most of the activities.

The material in this book can be used at different grade levels, depending on the learners' prior experiences with collecting and analyzing data. It is important that the data generated or collected by the students be interesting and meaningful to them.

The results of a research study (Curcio 1987) and suggestions of others (Landwehr and Watkins 1986; Nuffield Foundation 1967; Russell 1988) indicate that elementary and middle school students should be actively involved in collecting real-world data to construct their own simple graphs. Learners are encouraged to formulate questions that lead to collecting data (e.g., Who can tie shoes? Which languages do the children in our class speak?), to generate questions about the data collected (e.g., What do the data tell us? What don't the data tell us?), and to verbalize the relationships and patterns observed among the data (e.g., larger than, twice as big as, continuously increasing). In this way, the application of mathematics to the real world may enhance the students' concept development and build and expand their knowledge about mathematics relevant to comprehending the implicit mathematical relationships expressed in graphs.

The development of graph comprehension skills is not meant to be isolated from the rest of the curriculum. Graph reading is not limited to the study of mathematics. Graphs are found in elementary and middle school science and social

studies curricula. This book provides ideas for general skills development that can be incorporated across the curriculum. Although in other disciplines graphical representation includes graphs, maps, pictures, and diagrams that may not include numerical information, only graphs that present quantitative information are discussed in this book.

Several modifications have been made in this third edition of *Developing Data-Graph Comprehension in Grades K–8.* Activities related to integrating graphs from the newspaper and data from the Internet have been updated. Suggestions for using and integrating current technology have been included. The application of data and graphs to discussing social justice issues appears in several new activities.

There are eight sections in this book: (1) Graphs—What Are They, and How Are They Used?; (2) Levels of Graph Comprehension; (3) Collecting, Organizing, and Analyzing Data; (4) Inventing and Reinventing Graphical Displays of Data; (5) Constructing Conventional Graphs; (6) Interpreting and Writing about Graphs; (7) Using Technological Tools for Graphing and Analyzing Data; and (8) Classroom Activities. The major portion of this book consists of thirty activities, about one-third of which are new, revised, and updated, designed for immediate classroom use. References to computer software have been updated, and one activity makes reference to using the graphing calculator. Supplementary materials are given in the appendixes. These materials include supplemental graph-reading exercises, topics appropriate for children in grades K–8, instructions for constructing usable aids for teaching graphing skills, different sizes of graph paper, and samples of data collection sheets. The activities and supplemental materials are available for download at www.nctm.org/more4u.

The many teachers and children who participated in the field testing of these activities for the current and previous editions of this book are gratefully acknowledged. In particular, thanks are due to the following individuals, whose positions and school affiliations at the time of the field tests are given: Nicole Francipane, teacher, Queens School of Inquiry, Flushing, New York; Kate Abell, fourth- and fifth-grade teacher, Public School 11, New York City; Susan Folkson, mathematics coordinator, Community School District 25, Bayside, New York; Michelle McCabe, mathematics teacher, Intermediate School 70, New York City; Barbara Nimerofsky, Rossana Perez, and the late J. Lewis McNeese, teachers, Louis Armstrong Middle School, East Elmhurst, New York; and Phyllis Tam, staff developer, New York City Lab School.

Special thanks to Alice F. Artzt and Sydney L. Schwartz, Queens College of the City University of New York, who continue to inspire and challenge my thinking about the development of graph comprehension and for sharing their insights. However, I take full responsibility for any shortcomings in the presentation of this work.

Much of the groundwork for this third edition was established in the previous edition with the assistance of Chris Christopoulos and Peiji Tang. Their contributions are gratefully acknowledged.