

Preface

The primary purpose of *Mathematics for Elementary Teachers: An Activity Approach* is to engage prospective elementary- and middle-school teachers in mathematical activities that will enhance their conceptual knowledge, introduce them to important manipulatives, and model the kind of mathematical learning experiences they will be expected to provide for their students.

The National Council of Teachers of Mathematics' *Principles and Standards for School Mathematics* ("Standards 2000") and its predecessor, *Curriculum and Evaluation Standards for School Mathematics* ("Standards 1989"), strongly assert that students learn mathematics well when they construct their own mathematical thinking. Information can be transmitted from one person to another, but mathematical *understanding* and knowledge come from within the learner as that individual explores, discovers, and makes connections.

The National Council of Teachers of Mathematics' *Professional Standards for Teaching Mathematics* presents a vision of mathematics teaching that "redirects mathematics instruction from a focus on presenting content through lecture and demonstration to a focus on active participation and involvement." In this vision, "mathematics instructors do not simply deliver content; rather, they facilitate learners' construction of their own knowledge of mathematics."

This book contains activities and materials to actively engage students in mathematical explorations. It provides prospective elementary- and middle-school teachers the opportunity to examine and learn mathematics in a meaningful way. It also provides instructors with a variety of resources for making an interactive approach to mathematics the focus of their teaching.

OUR PHILOSOPHY

Mathematics for Elementary Teachers: An Activity Approach is a collection of activities for prospective teachers that involve and develop inductive and deductive reasoning. The activities enable students to think deeply about how manipulatives and visual models contribute to understanding mathematical concepts. Students experience mathematics directly by using models that embody concepts and promote mathematical thinking. This book reflects the beliefs that

- Prospective teachers who learn mathematics through appropriate use of manipulatives, models, and diagrams are more likely to develop a solid conceptual basis and a deeper understanding of the mathematics they will teach.
- Prospective teachers who learn mathematics by being actively involved in doing mathematics will be more likely to teach in the same manner.
- Prospective teachers who use manipulatives effectively in their learning will experience how manipulatives assist understanding and will be more likely to use them effectively in their teaching.
- Becoming familiar with manipulatives and models in structured activities will give prospective teachers confidence to develop lessons that use manipulatives and models.
- A concrete approach diminishes the mathematical anxiety that often accompanies a more abstract approach.
- Tactile and visual approaches provide mental images that, for some students, can be easily retained to provide understanding for symbolic representations.

USING MANIPULATIVES EFFECTIVELY AND SUCCESSFULLY

It is well known that effective teachers have a good understanding of the mathematics they teach and are skillful in choosing and using a variety of appropriate instructional techniques. The importance of using manipulatives in mathematics teaching and learning is well documented and amply illustrated in the pages of NCTM's Standards 2000. Research has shown that the appropriate use of manipulative materials has a significant positive effect on students' attitudes to learning and potential for achievement in mathematics.

Interviews with teachers successfully using manipulatives in classrooms revealed the following commonalities: the teachers had all received training for using manipulatives; they designed their own lessons and worked through them using manipulatives themselves; and they prepared for classroom use of the manipulatives by anticipating how the class would react to each activity.¹

FEATURES OF THE SEVENTH EDITION

Mathematics for Elementary Teachers: An Activity Approach consists of thirty-four Activity Sets and accompanying materials, which, collectively, constitute a self-contained mathematics laboratory. It contains many special features designed to enhance learning.

Active Learning Each Activity Set uses physical materials and/or visual models to provide a context for understanding. The questions and activities in each Activity Set are sequentially developed to encourage discovery and to provide an in-depth exploration of a topic.

(Updated) Manipulative Kit The Manipulative Kit contains the following 10 common manipulatives on color card stock together with storage bags:

Pattern Blocks	Base-Ten Pieces
Color Tiles	(New) Decimal Squares
Attribute Pieces	Fraction Bars
Red and Black Tiles	Polygons for Tessellations
Base-Five Pieces	Spinners for Simulations

(Updated) Material Cards In addition to the Manipulative Kit, the *Activity Approach* also offers thirty-seven Material Cards with additional manipulatives, models, grids, templates, and game mats.

(New) Virtual Manipulatives Now in an easy-to-use Flash-based interface, virtual versions of the Manipulative Kit components are available on the Online Learning Center for carrying out various activities online (*see the description of the Online Learning Center under Additional Resources, page x*).

(New) Activity Sets Two new Activity Sets, “Slope and Linear Functions on Geoboards” and “Collecting and Graphing Data,” have been added.

(New) Elementary School Activity At the end of each chapter, there is an *Elementary School Activity* that illustrates how ideas and manipulatives from the chapter can be adapted for use in the elementary classroom. Students may wish to try these activities with children and/or adapt other ideas from Activity Sets for activities that are appropriate for elementary-school students.

¹ Mary K. Stein and Jane W. Bovalino, “Manipulatives: One Piece of the Puzzle,” *Mathematics Teaching in the Middle School* 6 (February 2001): 356–359.

(New) Connections “Connections” questions at the end of each Activity Set ask students to relate the activities to the elementary classroom, to explore math concepts related to the activities, and to connect the concepts from the section to the NCTM Standards and Expectations.

(New) NCTM Standards A table of the NCTM Standards and Expectations for Grades Pre-K–2, 3–5, and 6–8 is provided in the back of the book for easy reference. Students can refer to it to answer the Connections questions or to see what mathematics is recommended at various grade levels.

Cooperative Learning The Activity Sets can be done individually or in small groups. In particular, Activity Set 2.3, “Logic Problems for Cooperative Learning Groups,” is specifically designed to provide opportunities for small-group interaction and guidelines to help facilitate this interaction.

Individual Reflections Each of the Activity Sets provides ideas that can be adapted to school classrooms to promote conceptual understanding and mathematical thinking. Throughout the Activity Sets and Connections questions, students are asked to describe patterns and to discuss their thinking. Students are encouraged to write explanations of their reasoning in the spaces provided after each question in the Activity Sets.

(Updated) Just for Fun Each Activity Set is followed by a “Just for Fun” activity. These are related to the topics of the Activity Sets and often relate to recreational activities or have an artistic aspect. Included in the Just for Fun activities are references to the Interactive Applets on the Online Learning Center.

Answer Section Answers to selected questions (marked with an asterisk) in the Activity Sets appear in the back of the book.

ADDITIONAL RESOURCES

Mathematics for Elementary Teachers: A Conceptual Approach, Seventh Edition (ISBN-13: 978-0-07-302284-0; ISBN-10: 0-07-302284-5) This is an optional companion volume to the *Activity Approach*. Its thirty-four sections each correspond to one of the Activity Sets. The text also contains a one-page Math Activity at the beginning of each section that utilizes the same Manipulative Kit materials as the *Activity Approach*. The *Activity Approach* and the *Conceptual Approach* are available packaged with the Manipulative Kit (ISBN-13: 978-0-07-345334-7; ISBN-10: 0-07-345334-X).

Instructor’s Resource Manual (ISBN-13: 978-0-07-321336-1; ISBN-10: 0-07-321336-5) The *Instructor’s Manual* to accompany *Mathematics for Elementary Teachers: An Activity Approach*, Seventh Edition, contains a brand-new set of section-by-section Planning Guides with detailed suggestions for teaching a course using the *Activity Approach*. The *Instructor’s Manual* includes answers for all of the Activity Set questions and the Just for Fun activities, as well as selected answers for the new end-of-section Connections questions. The *Instructor’s Manual* also provides a set of sample test questions, with answers, for each chapter of the *Activity Approach*.

Online Learning Center (www.mhhe.com/bennett-nelson) Now in an accessible Flash-based interface, the website for the *Activity Approach* offers a variety of resources for both instructors and students. The Online Learning Center enables you to

- Use Virtual Manipulatives to carry out various activities online using virtual colored manipulative pieces

- Access Interactive Mathematics Applets, one for each chapter, for exploring key mathematical concepts
- Explore thirty-four open-ended Math Investigations, one per Activity Set, including fourteen Investigations that use *Mathematics Investigator* software to generate data
- Download color masters for transparencies of the manipulatives in the Manipulative Kit and black-and-white masters for a variety of grid and dot papers
- Access extended bibliographies and Internet links for further research
- Download instructions and exercises for Network Graphs and Logo

Instructors can also use the website to access online versions of selected *Instructor's Resource Manual* items, such as an editable version of the section-by-section Planning Guides, editable chapter tests, and sample syllabi.

COURSE FORMATS

Many of the Activity Sets in *Mathematics for Elementary Teachers: An Activity Approach* are independent of each other and can be covered out of sequence (see the *Instructor's Resource Manual* for information on the Activity Set dependencies). The flexible coverage of the *Activity Approach* makes it possible for the book to be used effectively in a variety of course formats:

- **A lab course** based on the Activity Sets and supplemented with outside readings from a reference text or journals, with the Connections questions used for assignments
- **A combination lab and recitation course** in which the Activity Sets are integrated with discussions or lectures extending the ideas raised in the Activity Sets and developed further in *Mathematics for Elementary Teachers: A Conceptual Approach*
- **A traditional lecture/recitation course** in which the Activity Sets and Connections questions in the *Activity Approach* are used to supplement *Mathematics for Elementary Teachers: A Conceptual Approach*

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