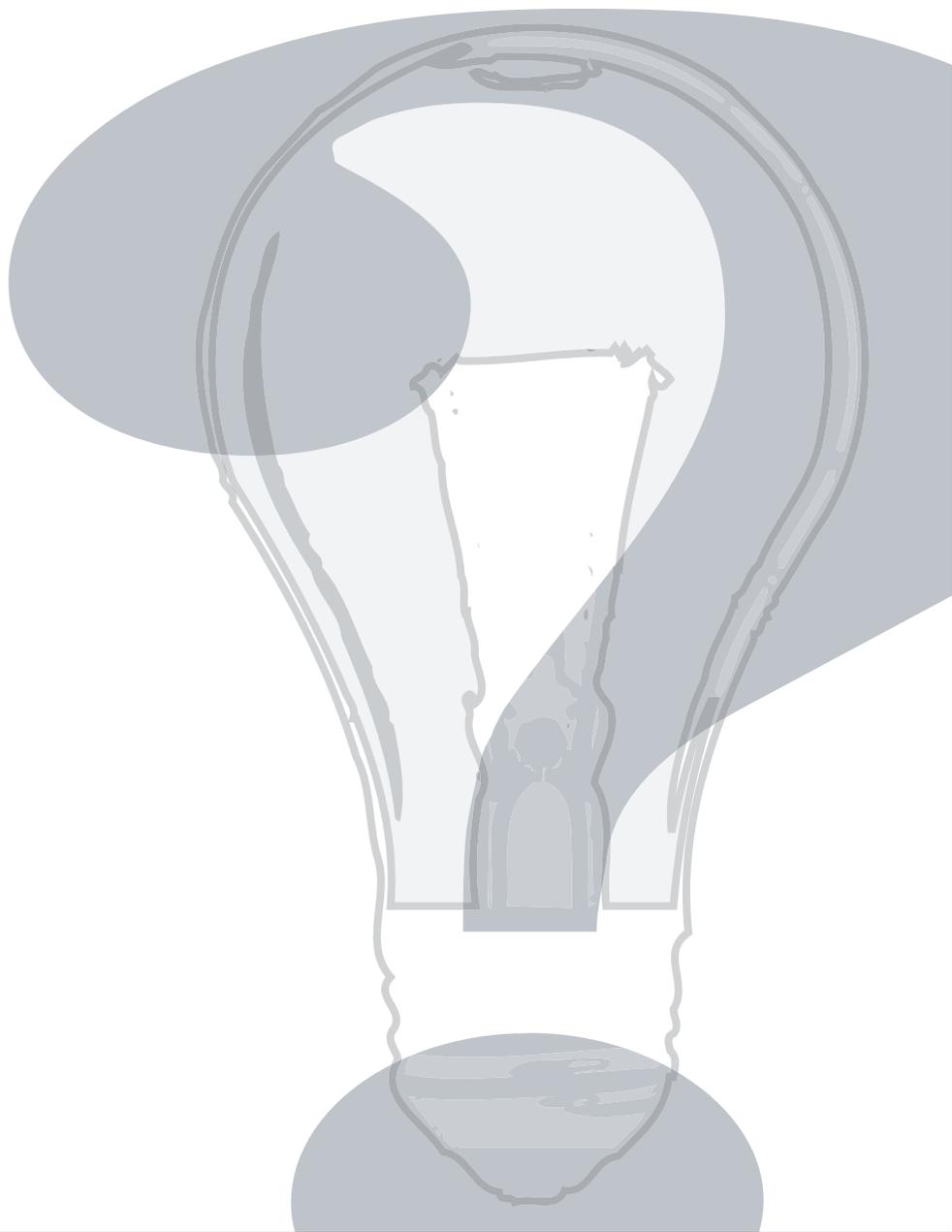


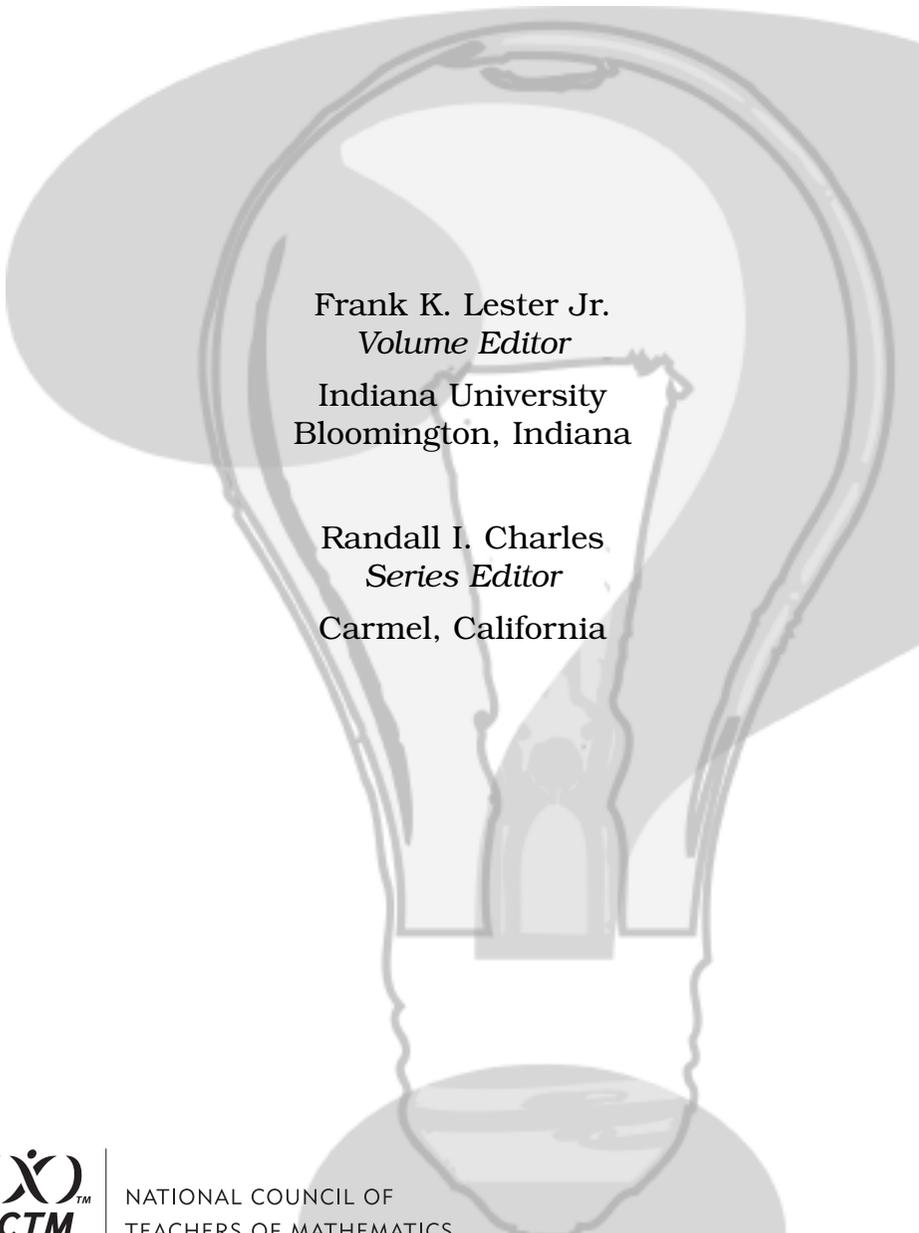
Teaching Mathematics through Problem Solving

Prekindergarten–Grade 6



Teaching Mathematics through Problem Solving

Prekindergarten–Grade 6



Frank K. Lester Jr.
Volume Editor

Indiana University
Bloomington, Indiana

Randall I. Charles
Series Editor

Carmel, California



NATIONAL COUNCIL OF
TEACHERS OF MATHEMATICS

Copyright © 2003 by

THE NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS, INC.

1906 Association Drive, Reston, VA 20191-1502

(703) 620-9840; (800) 235-7566; www.nctm.org

All rights reserved

Library of Congress Cataloging-in-Publication Data

Teaching mathematics through problem solving : prekindergarten-grade 6 /
Frank K. Lester, Jr., volume editor.

p. cm.

Includes bibliographical references.

ISBN 0-87353-540-5 (pbk.)

1. Mathematics--Study and teaching (Elementary)--United States. 2.

Mathematics--Study and teaching (Early childhood)--United States. 3.

Problem-based learning. I. Lester, Frank K.

QA13.T4315 2003

372.7--dc22

2003021744

The publications of the National Council of Teachers of Mathematics present a variety of viewpoints. The views expressed or implied in this publication, unless otherwise noted, should not be interpreted as official positions of the Council.

Printed in the United States of America

CONTENTS

Preface	ix
<i>Frank K. Lester Jr., Indiana University, Bloomington, Indiana</i>	
<i>Randall I. Charles, Carmel, California</i>	
Section 1: Issues and Perspectives	1
1 Benefits of Teaching through Problem Solving	3
<i>Diana V. Lambdin, Indiana University, Bloomington, Indiana</i>	
2 Mathematical Habits of Mind for Young Children	15
<i>E. Paul Goldenberg, Education Development Center, Newton, Massachusetts</i>	
<i>Nina Shteingold, Education Development Center, Newton, Massachusetts</i>	
<i>Nannette Feurzeig, Education Development Center, Newton, Massachusetts</i>	
Teacher Story 1: Drawing Geoblocks	31
<i>Melissa Hartemink, Durham, North Carolina</i>	
3 Teaching Mathematics through Problem Solving: A Historical Perspective	37
<i>Beatriz D'Ambrosio, Indiana University–Purdue University, Indianapolis, Indiana</i>	
Section 2: In the Classroom	51
4 Signposts for Teaching Mathematics through Problem Solving	53
<i>James Hiebert, University of Delaware, Newark, Delaware</i>	
Teacher Story 2: Strategies for Separating	63
<i>Malia Scott, Brookline Public Schools, Brookline, Massachusetts</i>	
5 Designing and Selecting Problem-Based Tasks	67
<i>John A. Van de Walle, Virginia Commonwealth University, Richmond, Virginia</i>	
Teacher Story 3: Reassembling the Hundred Chart	81
<i>Malia Scott, Brookline Public Schools, Brookline, Massachusetts</i>	

6	How to Focus the Mathematics Curriculum on Solving Problems	85
	<i>Susan Jo Russell, Education Research Collaborative, Cambridge, Massachusetts</i>	
	<i>Rebeka Eston, Lincoln Public Schools, Lincoln, Massachusetts</i>	
	<i>Jan Rook, Boston Public Schools, Boston, Massachusetts</i>	
	<i>Malia Scott, Brookline Public Schools, Brookline, Massachusetts</i>	
	<i>Liz Sweeney, Boston Public Schools, Boston, Massachusetts</i>	
	Teacher Story 4: How Many 4s in 100? Where Do We Go from Here?	101
	<i>Nancy Buell, Brookline Public Schools, Brookline, Massachusetts</i>	
7	Listening to Children: Informing Us and Guiding Our Instruction	107
	<i>Erna Yackel, Purdue University Calumet, Hammond, Indiana</i>	
	Teacher Story 5: Listening to One Another: “Ears Open, Mouths Closed”	123
	<i>Liz Sweeney, Boston Public Schools, Boston, Massachusetts</i>	
8	Reflecting on Teaching Mathematics through Problem Solving	127
	<i>Frances R. Curcio, Queens College of the City University of New York, Flushing, New York</i>	
	<i>Alice F. Artzt, Queens College of the City University of New York, Flushing, New York</i>	
	Teacher Story 6: Ordering Rectangles: Which Is Bigger?	143
	<i>Jan Dwyer, Boston Public Schools, Boston, Massachusetts</i>	
9	Establishing Classroom Social and Sociomathematical Norms for Problem Solving	149
	<i>Michelle Stephan, Purdue University Calumet, Hammond, Indiana</i>	
	<i>Joy Whitenack, James Madison University, Harrisonburg, Virginia</i>	
	Teacher Story 7: Motivating Students to Engage in Problem Solving	163
	<i>Jennifer Strabala, Metropolitan School District of Lawrence Township, Indianapolis, Indiana</i>	

10	Addressing the Needs of Exceptional Students through Problem Solving	169
	<i>Carmel M. Diezmann, Queensland University of Technology, Brisbane, Australia</i>	
	<i>Carol A. Thornton, Illinois State University, Normal, Illinois</i>	
	<i>James J. Watters, Queensland University of Technology, Brisbane, Australia</i>	
	Teacher Story 8: Supporting Second-Language Learners in the Mathematics Classroom	183
	<i>Jan Rook, Boston Public Schools, Boston, Massachusetts</i>	
11	Engaging Students in Problem Posing in an Inquiry-Oriented Mathematics Classroom	187
	<i>Lyn D. English, Queensland University of Technology, Brisbane, Australia</i>	
	Teacher Story 9: Job Tickets: Collecting and Analyzing Data	199
	<i>Jan Szymaszek, Smith College Campus School, Northampton, Massachusetts</i>	
12	Problem Solving as a Vehicle for Teaching Mathematics: A Japanese Perspective	205
	<i>Yoshinori Shimizu, Tokyo Gakugei University, Tokyo, Japan</i>	
	Section 3: The Role of Technology	215
13	Using Technology to Enhance a Problem-Based Approach to Teaching: What Will and What Will Not Work	217
	<i>Warren D. Crown, Rutgers University, New Brunswick, New Jersey</i>	
14	Computer Technologies and Teaching Geometry through Problem Solving	229
	<i>Michael T. Battista, Michigan State University, East Lansing, Michigan</i>	
	Section 4: Research	239
15	What Research Tells Us about Teaching Mathematics through Problem Solving	241
	<i>Jinfa Cai, University of Delaware, Newark, Delaware</i>	
	Section 5: References	255