

Mathematics Classrooms That Promote Understanding

Edited by
Elizabeth Fennema and
Thomas A. Romberg

Research in Mathematics Teaching and Learning Series

Mathematics Classrooms That Promote Understanding

**Chiara Andrà, Domenico
Brunetto, Esther Levenson, Peter
Liljedahl**



Mathematics Classrooms That Promote Understanding:

Mathematics Classrooms That Promote Understanding Elizabeth Fennema, Thomas A. Romberg, 1999-04-01

Mathematics Classrooms That Promote Understanding synthesizes the implications of research done by the National Center for Research in Mathematical Sciences on integrating two somewhat diverse bodies of scholarly inquiry the study of teaching and the study of learning mathematics This research was organized around content domains and or continuing issues of education such as equity and assessment of learning and was guided by two common goals defining the mathematics content of the K 12 curriculum in light of the changing mathematical needs of citizens for the 21st century and identifying common components of classrooms that enable students to learn the redefined mathematics with understanding To accomplish these goals classrooms in which instruction facilitated the growth of understanding were established and or studied This volume reports and discusses the findings which grew out of this research and subsequent papers and discussions among the scholars engaged in the endeavor Section I Setting the Stage focuses on three major threads What mathematics should be taught how we should define and increase students understanding of that mathematics and how learning with understanding can be facilitated for all students Section II Classrooms That Promote Understanding includes vignettes from diverse classrooms that illustrate classroom discourse student work and student engagement in the mathematics described in Chapter 1 as well as the mental activities described in Chapter 2 These chapters also illustrate how teachers deal with the equity concerns described in Chapter 3 Section III addresses Developing Classrooms That Promote Understanding The knowledge of the teaching learning process gained from the research reported in this volume is a necessary prerequisite for implementing the revisions called for in the current reform movement The classrooms described show that innovative reform in teaching and learning mathematics is possible Unlike many volumes reporting research this book is written at a level appropriate for master s degree students Very few references are included in the chapters themselves instead each chapter includes a short annotated list of articles for expanded reading which provides the scholarly basis and research substantiation for this volume

Teaching Mathematics in Diverse Classrooms Benny F. Tucker, Ann H. Singleton, Terry L. Weaver, 2013 Through a variety of straight forward easy to use lesson plans and learning activities that illustrate specific mathematical concepts and skills this title emphasizes the premise that effective mathematics teaching promotes understanding and understanding provides sound bases for skill development and better retention of material

Teaching Mathematics in Diverse Classrooms for Grades K-4 Benny F. Tucker, Ann H. Singleton, Terry L. Weaver, 2013 The book emphasizes that effective mathematics teachers plan lessons that include a more complete development of mathematical ideas use visuals supporting mental imagery present opportunities for kinesthetic learning activities provide chances for children to communicate their understanding of mathematics and allow for continual monitoring of student learning Lessons include straightforward easy to use learning activities illustrating specific mathematical concepts and skills visuals to help

develop mental imagery and opportunities for active student learning publisher website Second Handbook of Research on Mathematics Teaching and Learning Frank K. Lester, 2007-02-01 The audience remains much the same as for the 1992 Handbook namely mathematics education researchers and other scholars conducting work in mathematics education This group includes college and university faculty graduate students investigators in research and development centers and staff members at federal state and local agencies that conduct and use research within the discipline of mathematics The intent of the authors of this volume is to provide useful perspectives as well as pertinent information for conducting investigations that are informed by previous work The Handbook should also be a useful textbook for graduate research seminars In addition to the audience mentioned above the present Handbook contains chapters that should be relevant to four other groups teacher educators curriculum developers state and national policy makers and test developers and others involved with assessment Taken as a whole the chapters reflects the mathematics education research community's willingness to accept the challenge of helping the public understand what mathematics education research is all about and what the relevance of their research findings might be for those outside their immediate community **Teaching Mathematics in Diverse Classrooms for Grades 5-8** Benny F. Tucker, 2013 With this guide teaching mathematics is made more effective through straightforward easy to use lesson plans and learning activities that illustrate specific mathematical concepts and skills ideas for using visuals to develop mental imagery and ways to promote active student learning using movement and student discussion The development of the content is user friendly and based on a small number of easy to understand and easy to teach big ideas and the many activities help to emphasize and reinforce the development of the mathematical content Publisher website

Teaching in the Standards-based Classroom, 2001 Virtually every national standards document every state framework and every local set of standards calls for fundamental changes in what and how teachers teach The challenge for teachers is to implement the vision for mathematics and science classrooms called for in the standards This issue describes that vision and suggests ways to use the standards mandated in your school to improve your practice to help you teach in your standards based classroom **Mathematical Tasks in Classrooms Around the World**, 2010-01-01 Mathematical tasks have long been recognized as crucial mediators between mathematical content and the mathematics learner For many people the mathematics classroom is defined by the type of tasks one finds there and this is appropriate Mathematical tasks are the embodiment of the curricular pretext that brings each particular set of individuals together in every mathematics classroom In other contexts individuals come together to engage in musical performances or dramatic performances The performances of the mathematics classroom are largely the performance of mathematical tasks and if we are to understand and facilitate the learning that is the purpose of such settings then we must understand the nature of the performances that we find there The classroom performance of a task is ultimately a unique synthesis of task teacher students and situation Of particular interest are differences in the function of mathematically similar tasks when employed by different teachers in

different classrooms for different instructional purposes with different students By making comparison possible between the classroom use of mathematical tasks in different classrooms around the world the analyses reported in this book reveal the profound differences in how each teacher utilises mathematical tasks in partnership with their students to create a distinctive form of mathematical activity The Learner s Perspective Study aims to juxtapose the observable practices of the classroom and the meanings attributed to those practices by classroom participants The LPS research design documents sequences of at least ten lessons using three video cameras supplemented by the reconstructive accounts of classroom participants obtained in post lesson video stimulated interviews and by test and questionnaire data and copies of student written material In each participating country data generation focuses on the classrooms of three teachers identified by the local mathematics education community as competent and situated in demographically different school communities within the one major city The large body of complex data supports both the characterisation of practice in the classrooms of competent teachers and the development of theory

How Chinese Teach Mathematics and Improve Teaching Yeping Li,Rongjin Huang,2013 How Chinese Teach Mathematics and Improve Teaching builds upon existing studies to examine mathematics classroom instruction in China It combines contributions from Chinese scholars with commentary from key Western scholars to offer a truly systematic examination of some important and distinctive features of mathematics classroom instruction Viewing classroom instruction as part of teachers instructional practices this book goes beyond teachers in classroom instructional practice by also examining Chinese teachers approaches and practices in developing and improving teaching Through this unique approach How Chinese Teach Mathematics and Improve Teaching expands and unpacks the otherwise fragmented knowledge about Chinese practices in developing and carrying out mathematics classroom instruction

Mathematical Understanding for Secondary Teaching M. Kathleen Heid,Patricia S. Wilson,Glendon W. Blume,2015-12-01 A perennial discussion about teacher development is the optimal content background for teachers In recent years that discussion has taken center stage in the work of mathematics education researchers mathematicians mathematics professional developers and mathematics education policymakers Much of the existing and prior work in this area has been directed toward mathematical knowledge for teaching at the elementary level The work described in this volume takes a sometimes neglected approach focusing on the dynamic nature of mathematical understanding rather than on a stable description of mathematical knowledge and on mathematics for secondary teaching rather than mathematics for teaching at the elementary level The work reported in *Mathematical Understanding for Secondary Teaching A Framework and Classroom Based Situations* is a practice based response to the question of what mathematical understandings secondary teachers could productively use in their teaching For each of more than 50 events our team of almost 50 mathematics educators who were experienced mathematics teachers developed descriptions of the mathematics that teachers could use each of those descriptions consisting of the event and the mathematics related to the event is what we call a Situation We

developed our Framework for Mathematical Understanding for Secondary Teaching MUST based on an analysis of our entire set of Situations We call the work practice based because the MUST framework is based on actual events that we witnessed in our observations of secondary mathematics practice Groups of mathematics teachers can use this volume to enhance their own understandings of secondary mathematics School leaders and professional developers in secondary mathematics will find our MUST Framework and Situations useful as they work with teachers in enhancing and deepening their understanding of secondary mathematics Mathematics teacher educators and mathematicians who teach mathematics to prospective and in service secondary teachers will be able to couch their mathematical discussions in the Situations examples that arise from secondary mathematics classrooms They will be able to use this volume as they design courses and programs that enhance mathematics from the perspectives identified in the MUST framework Policymakers and researchers can use our MUST framework as they consider the mathematics background needed by teachers

Algebra in the Early Grades James J. Kaput, David W. Carraher, Maria L. Blanton, 2017-09-25 This volume is the first to offer a comprehensive research based multifaceted look at issues in early algebra In recent years the National Council for Teachers of Mathematics has recommended that algebra become a strand flowing throughout the K 12 curriculum and the 2003 RAND Mathematics Study Panel has recommended that algebra be the initial topical choice for focused and coordinated research and development in K 12 mathematics This book provides a rationale for a stronger and more sustained approach to algebra in school as well as concrete examples of how algebraic reasoning may be developed in the early grades It is organized around three themes The Nature of Early Algebra Students Capacity for Algebraic Thinking Issues of Implementation Taking Early Algebra to the Classrooms The contributors to this landmark volume have been at the forefront of an effort to integrate algebra into the existing early grades mathematics curriculum They include scholars who have been developing the conceptual foundations for such changes as well as researchers and developers who have led empirical investigations in school settings Algebra in the Early Grades aims to bridge the worlds of research practice design and theory for educators researchers students policy makers and curriculum developers in mathematics education

Handbook of International Research in Mathematics Education Lyn D. English, David Kirshner, 2010-04-02 This book brings together mathematics education research that makes a difference in both theory and practice research that anticipates problems and needed knowledge before they become impediments to progress

A Focus on Fractions Marjorie M. Petit, Robert E. Laird, Caroline B. Ebby, Edwin L. Marsden, 2015-07-24 A Focus on Fractions is a groundbreaking effort to make the mathematics education research on how students develop their understanding of fraction concepts readily accessible and understandable to pre and in service K 8 mathematics educators Using extensive annotated samples of student work as well as vignettes characteristic of classroom teachers experiences this book equips educators with the knowledge and tools to reveal students thinking so that they can modify their teaching and improve student learning of fraction concepts A Focus on Fractions 2nd edition includes sections

on the Common Core State Standards for Mathematics and the Ongoing Assessment Project OGAP Fraction Framework integrated into each chapter as well as a new chapter on the OGAP Fraction Progression and how it can be used for formative assessment purposes This updated edition assists teachers in translating research findings into their classroom practice by conveying detailed information about how students develop fraction understandings Additional images and examples serve to flesh out and supplement the newly introduced concepts in this updated and expanded edition Special Features Looking Back Questions at the end of each chapter provide teachers the opportunity to analyze student thinking and consider instructional strategies for their own students Instructional Links help teachers relate concepts from the chapter to their own instructional materials and programs Big Ideas frame the chapters and provide a platform for meaningful exploration of the teaching of fractions Answer Key posted online offers extensive explanations of in chapter questions New sections devoted to the CCSSM and OGAP Fraction Progression are woven throughout the book as well as a new stand alone chapter on the OGAP Fraction Progression The OGAP Fraction Framework is an all new eResource now available as a free download from the book s website www.routledge.com/9781138816442

On Evaluating Curricular Effectiveness National Research Council, Division of Behavioral and Social Sciences and Education, Center for Education, Mathematical Sciences Education Board, Committee for a Review of the Evaluation Data on the Effectiveness of NSF-Supported and Commercially Generated Mathematics Curriculum Materials, 2004-11-12 This book reviews the evaluation research literature that has accumulated around 19 K 12 mathematics curricula and breaks new ground in framing an ambitious and rigorous approach to curriculum evaluation that has relevance beyond mathematics The committee that produced this book consisted of mathematicians mathematics educators and methodologists who began with the following charge Evaluate the quality of the evaluations of the thirteen National Science Foundation NSF supported and six commercially generated mathematics curriculum materials Determine whether the available data are sufficient for evaluating the efficacy of these materials and if not Develop recommendations about the design of a project that could result in the generation of more reliable and valid data for evaluating such materials The committee collected reviewed and classified almost 700 studies solicited expert testimony during two workshops developed an evaluation framework established dimensions criteria for three methodologies content analyses comparative studies and case studies drew conclusions on the corpus of studies and made recommendations for future research

Technology in Mathematics Education: Contemporary Issues Dragana Martinovic, Douglas McDougall, Zerkeriya Karadag, 2012

Mathematical and Analogical Reasoning of Young Learners Lyn D. English, 2004-07-19 This book draws upon studies of the development of young children s mathematical and analogical reasoning in the United States and Australia to address a number of significant issues in the mathematical development of young children

What We Know About Mathematics Teaching and Learning McREL, 2011-09-20 This book supports mathematics education reform and brings the rich world of education research and

practice to pre K 12 educators Designed for accessibility each chapter is broken down into important questions For each question the authors provide background information from a research perspective offer implications for improving classroom instruction and list resources for further reading

The Future of the Teaching and Learning of Algebra Kaye Stacey, Helen Chick, Margaret Kendal, 2006-04-11 Kaye Stacey Helen Chick and Margaret Kendal The University of Melbourne Australia Abstract This section reports on the organisation procedures and publications of the ICMI Study The Future of the Teaching and Learning of Algebra Key words Study Conference organisation procedures publications The International Commission on Mathematical Instruction ICMI has since the 1980s conducted a series of studies into topics of particular significance to the theory and practice of contemporary mathematics education Each ICMI Study involves an international seminar the Study Conference and culminates in a published volume intended to promote and assist discussion and action at the international national regional and institutional levels The ICMI Study running from 2000 to 2004 was on The Future of the Teaching and Learning of Algebra and its Study Conference was held at The University of Melbourne Australia from December to 2001 It was the first study held in the Southern Hemisphere There are several reasons why the future of the teaching and learning of algebra was a timely focus at the beginning of the twenty first century The strong research base developed over recent decades enabled us to take stock of what has been achieved and also to look forward to what should be done and what might be achieved in the future In addition trends evident over recent years have intensified Those particularly affecting school mathematics are the massification of education continuing in some countries whilst beginning in others and the advance of technology

Teaching and Learning in Maths Classrooms Chiara Andrà, Domenico Brunetto, Esther Levenson, Peter Liljedahl, 2017-05-03 The book presents a selection of the most relevant talks given at the 21st MAVI conference held at the Politecnico di Milano The first section is dedicated to classroom practices and beliefs regarding those practices taking a look at prospective or practicing teachers views of different practices such as decision making the roles of explanations problem solving patterning and the use of play Of major interest to MAVI participants is the relationship between teachers professed beliefs and classroom practice aspects that provide the focus of the second section Three papers deal with teacher change which is notoriously difficult even when the teachers themselves are interested in changing their practice In turn the book s third section centers on the undercurrents of teaching and learning mathematics which can surface in various situations causing tensions and inconsistencies The last section of this book takes a look at emerging themes in affect related research with a particular focus on attitudes towards assessment The book offers a valuable resource for all teachers and researchers working in this area

European and Chinese Cognitive Styles and their Impact on Teaching Mathematics Filippo Spagnolo, Benedetto Di Paola, 2010-04-05 The book provides strong evidence that research on the cognitive processes from arithmetic thought to algebraic thought should take into consideration the socio cultural context It is an important contribution to the literature on linguistic structure in comparative

studies related to Chinese student mathematics learning This book not only makes a great contribution to research in mathematics education the findings of this study also addressed insightful approaches and thoughts of understanding the development of algebraic thinking in cultural contexts for classroom teachers Using written Chinese language from different theoretical references provided wonderful approaches for understanding student algebra cognitive development in a different way and calls educators for to pay special attention to an epistemological and linguistic view of algebraic development The findings inform classroom teachers that the cultural context plays an important role in student learning mathematics A typical analysis of the cognitive dimension involved in some in the historical and cultural contexts is a great resource for classroom teachers I really enjoyed reading this book and learned a lot from its compelling analysis Shuhua An Associate Professor and Director of Graduate Program in Mathematics Education California State University Long Beach

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