
Mathematical and Analogical Reasoning of Young Learners

The challenges we face in mathematics education today can only be overcome through thoughtful and collaborative effort. This 2017 volume of Annual Perspectives in Mathematics Education (APME) focuses on collaborative initiatives that engage every level of the math education community, including practicing and preservice teachers, school administrators, teacher educators, and university mathematicians. The book's twenty-four chapters are grouped into five sections: Enhancing Mathematics Teaching from the Teacher's Voice: Enhancing Mathematics Teaching within Schools and District Models and Frameworks for Enhancing Mathematics Teaching Enhancing Mathematics Teaching across Multiple Stakeholders: Enhancing Preservice Mathematics Teachers' Development. These chapters describe a wide variety of collaborative initiatives, including professional learning communities, teacher teams, peer collaborations, and lesson study groups. Throughout the volume, we meet teachers who are actively engaged with peers, coaches, and university partners in designing and directing their own professional growth. The initiatives described here provide teachers with the sustainable tools they need to reflect on and improve their practice. The result is teachers who are more empowered and better able to deliver high-quality instruction to students at all levels.

Mathematical Proficiency for All Students: Toward a Strategic Research and Development Program in Mathematics Education

This unique volume surveys recent research on spatial visualization in mathematics education. The general topic of spatial skill and mathematics has a long research tradition, but has been gaining attention in recent years, although much of this research happens in disconnected subfields. This volume aims to promote interaction between researchers, not only to provide a more comprehensive view of spatial visualization and mathematics, but also to stimulate innovative new directions in research based on a more coordinated effort. It features ten chapters authored by leading researchers in cognitive psychology and mathematics education, as well as includes dynamic commentaries by mathematics education researchers on cognitive psychology chapters, and by cognitive psychologists on mathematics education chapters. Among the topics included: From intuitive spatial measurement to understanding of units. Spatial reasoning: a critical problem-solving tool in children's mathematics strategy tool-kit. What processes underlie the relation between spatial skill and mathematics? Learning with and from drawing in early years geometry. Communication of visual information and complexity of reasoning by mathematically talented students. Visualizing Mathematics makes substantial progress in understanding the role of spatial reasoning in mathematical thought and in connecting various subfields of research. It promises to make an impact among psychologists, education scholars, and mathematics educators in the convergence of psychology and education.


Mathematics education research has blossomed into many different areas, which we can see in the programmes of the ICME conferences, as well as in the various survey articles in the Handbooks. However, all of these lines of research are trying to grapple with the complexity of the same process of learning mathematics. Although our knowledge of the process is through fragmentation of research more extensive and deeper there is a need to overcome this fragmentation and to see learning as one process with different aspects. To overcome this fragmentation, this book identifies six themes: (1) mathematics, culture, and society; (2) the structure of mathematics and its influence on the learning process; (3) mathematics and cognitive processes; (4) mathematics learning as a cognitive process; (5) affective conditions of the learning process; (6) new technologies and mathematics learning. This book is addressed to all researchers in mathematics education. It gives an orientation and overview on what is going on and what are the main results and questions what are important books or papers if further information is needed.

Mathematics Instructional Practices in Singapore Secondary Schools

A clear need exists for substantial improvement in mathematics proficiency in U.S. schools. The RAND Mathematics Study Panel was convened to inform the U.S. Department of Education's Office of Educational Research and Improvement on ways to improve the quality and usability of education research and development (R&D). The panel identified three areas for focused R&D: development of teachers' mathematical knowledge used in teaching; teaching and learning of skills needed for mathematical thinking and problem-solving; and teaching and learning of algebra from kindergarten through the 12th grade.

Register of Educational Research in the United Kingdom, 1992-1995

The Chicago Renaissance has long been considered a less important literary movement for American modernism than the Harlem Renaissance. The Chicago Renaissance had its origin around the turn of the nineteenth century, from 1890 to 1910, gathered momentum in the 30s, and paved the way for the postmodern and postcolonial development in American literature even since. Yoshinobu Hakutani aims to shed light on this seldom studied, yet pivotal period, by studying some of its most influential works and authors, from Theodore Dreiser in the late 1890's to Richard Wright through the mid 1900's.

Mathematics Education

Mathematical and Analogical Reasoning of Young Learners provides foundational knowledge of the nature, development, and assessment of mathematical and analogical reasoning in young children. Reasoning is fundamental to understanding mathematics and is identified as one of the 10 key standards for school mathematics for the new millennium. The book draws on longitudinal and cross-cultural studies, conducted in the United States and Australia, of children's reasoning development as they progressed from preschool through the end of second grade. The multifaceted analysis of young children's development of mathematical and analogical reasoning...
Symbolizing, Modeling, and Tool Use in Mathematics Education

This document contains the fourth volume of the proceedings of the 28th annual conference of the International Group for the Psychology of Mathematics Education. The conference presentations are centered around the theme "Inclusion and Diversity." This volume features 64 research papers. The papers range from "The Effect of Combining Context and Structure on Constructing an Additive (Part-Part-Whole) Schema" (Irito Fedul and Rachel Meron) to "Using Graphical Profiles to Study the Learning and Teaching of Mathematics (Developmental) Proportional Reasoning: A Role of Positive and Negative Descriptive Generalisations" (Karen R. Lee). The volume includes papers on diverse topics such as assessment in mathematics education, the role of technology in learning, and the development of mathematical thinking. It is a valuable resource for researchers, educators, and students interested in the latest developments in mathematics education.

Early Algebraization

This book is the result of a conference sponsored by the Educational Testing Service and the University of Wisconsin's National Center for Research in Mathematics Education. The purpose of the conference was to facilitate the work of a group of scholars whose interests included the assessment of higher-order understandings and practices in mathematics education. The book contains papers on various topics such as the role of technology in algebra education, the development of mathematical reasoning, and the use of models in teaching algebra. It is a valuable resource for researchers, educators, and students interested in the latest developments in mathematics education.

Online Library Mathematics Education Models And Processes
Online Library Mathematics Education Models And Processes

A Focus on Addition and Subtraction

New Mathematics Education Research and Practice

Research by cognitive psychologists and mathematics educators has often been compartmentalized by departmental boundaries. Word Problems integrates this research to show its relevance to the debate on the reform of mathematics education. Beginning with the different knowledge structures that represent rule learning and conceptual learning, the discussion proceeds to the application of these ideas to solving word problems. This is followed by chapters on elementary, multistep, and algebra problems, which examine similarities and differences in the cognitive skills required by students as the problems become more complex. The next section, on abstracting, adapting, and representing solutions, illustrates different ways in which solutions can be transferred to related problems. The last section focuses on topics emphasized in the NCTM Standards and concludes with a chapter that evaluates some of the programs on curriculum reform.

Assessment of Authentic Performance in School Mathematics

Mathematical Reasoning

This latest volume of the Register of Educational Research in the United Kingdom lists all the major research projects being undertaken in Britain during the latter months of 1992, the whole of 1993 and 1994 and the early months of 1995. Each entry provides names and addresses of the researchers, a detailed abstract, the source and amount of the grant (where applicable), the length of the project and details of published material about the research.

Mathematics Education as a Research Domain: A Search for Identity

Mathematics is traditionally seen as the most neutral of disciplines, the furthest removed from the arguments and controversy of politics and social life. However, critical mathematics challenges these assumptions and actively attacks the idea that mathematics is pure, objective, and value-neutral. It argues that history, society, and politics have shaped mathematics—not only through its applications and uses but also through molding its concepts, methods, and even mathematical truth and proof, the very means of establishing truth. Critical mathematics education also attacks the neutrality of the teaching and learning of mathematics, showing how these are value-laden activities indivisibly linked to social and political life. Instead, it argues that the values of openness, dialogicality, criticality towards received opinion, empowerment of the learner, and social/political engagement and citizenship are necessary dimensions of the teaching and learning of mathematics, if it is to contribute towards democracy and social justice. This book draws together critical theoretic contributions on mathematics and mathematics education from leading researchers in the field. Recurring themes include: The natures of mathematics and critical mathematics education, issues of epistemology and ethics; Ideology, the hegemony of mathematics, ethnomathematics, and real/life education; Capitalism, globalization, politics, social class, habitus, citizenship and equity.

The book demonstrates the links between these themes and the discipline of mathematics, and its critical teaching and learning. The outcome is a groundbreaking collection unified by a shared concern with critical perspectives of mathematics and education, and of the ways they impact on practice.

Visualizing Mathematics

The name of Zoltan P. Dienes (1916-) stands with those of Jean Piaget and Jerome Bruner as a legendary figure whose theories of learning have left a lasting impression on the field of mathematics education. Dienes' name is synonymous with the Multi-base blocks (also known as Dienes blocks) which he invented for the teaching of place value. He also is the inventor of Algebraic materials and logic blocks, which sowed the seeds of contemporary uses of manipulative materials in mathematics instruction. Dienes' place is unique in the field of mathematics education because of his theories on how mathematical structures can be taught from the early grades onwards using multiple embodiments through manipulatives, games, stories and dance. Dienes' notion of embodied knowledge presaged other cognitive scientists who eventually came to recognize the importance of embodied knowledge and situated cognition - where knowledge and abilities are organized around experience as much as they are organized around abstractions. Dienes was an early pioneer in what was later to be called sociocultural perspectives and democratization of learning. This monograph compiled and edited by Bharath Sriraman honors the seminal contributions of Dienes to mathematics education and includes several recent unpublished articles written by Dienes himself. These articles exemplify his principles of guided discovery learning and reveal the non-trivial mathematical structures that can be made accessible to any student. The monograph also includes a rare interview with Dienes in which he reflects on his life, his work, the role of context, language and technology in mathematics teaching and learning today. The book finds an important place in any mathematics education library and is vital reading for mathematics education researchers, cognitive scientists, prospective teachers, graduate students and teachers of mathematics.

The First Sourcebook on Nordic Research in Mathematics Education

The frame of reference that this book sets for itself is strictly defined: to disentangle and follow the trends in mathematical education at the primary and middle school levels in China from 1860 to 1970, with particular emphasis on developments undertaken by the Communist government. The documentation that supports this effort is equally specific—it includes syllabi, textbook lists, subject scope descriptions and subject sequences, sample lesson plans, and examinations. But in addition to fulfilling this program, the book explicitly explores several implications of much wider import. For one, since modern technology is solidly based on mathematics, an index to the development of China's technical skills can be inferred from an examination of mathematical education over the last decades, and some insight into China's potential in the next generation can be gained by studying the way mathematics is being taught to the primary and middle school pupils of today. For another, the book examines the effects of Western mathematical concepts and teaching methods—imported mainly from America during the Republican and Kuomintang periods, and from Russia during the early Communist period—on the ancient mathematical tradition embedded in Chinese culture. The book also cites the lessons that the Chinese experience in this educational area may have for other developing countries. Among the other subjects examined are the present effects of the "Great Cultural Revolution" on mathematics instruction and the extent to which courses in "pure" mathematics may have been diluted or tainted by the introduction of political indoctrination; the influence of Soviet models on the establishment of "Olympiad" competitions to seek out mathematical talent and of special schools for students with such talent; the ways in which "practical applications" are being introduced into mathematics teaching; the efforts the Chinese have made to solve their teacher shortages and the extent to which psychological processes of mathematics learning are being considered in developing programs of instruction.

Mathematical Modelling

No one disputes how important it is, in today's world, to prepare students to understand mathematics as well as to use and communicate mathematics in their future lives. That task is very difficult, however. Refocusing curricula on fundamental concepts, producing new teaching materials, and designing teaching units based on mathematicians' common sense (or on logic) have not resulted in a better understanding of mathematics by more students. The failure of such efforts has raised questions suggesting that what was missing at the outset of these proposals, designs, and productions was a more profound knowledge of the phenomena of learning and teaching mathematics in socialized and culturally, politically, and economically justified institutions—namely, schools. Such knowledge cannot be built by mere juxtaposition of theories in distinct planes such as psychology, sociology, and mathematics. Psychological theories focus on the individual learner. Theories of sociology of education look at the general laws of curriculum development, the specifics of pedagogic discourse as opposed to scientific discourse in general, the different possible pedagogic relations between the teacher and the taught, and other general problems in the inter face between education and society. Mathematics, aside from its theoretical contents, can be looked at from historical and epistemological points of view, clarifying the genetic development of its concepts, methods, and theories. This view can shed some light on the meaning of mathematical concepts and on the attitudes students have in teaching approaches that disregard the genetic development of
Processes

Uses of Technology in Upper Secondary Mathematics Education

This survey provides an overview of the German discussion on modelling and applications in schools. It considers the development from the beginning of the 20th century to the present, and discusses the term "mathematical model" as well as different representations of the modelling process as modelling cycles. Different trends in the historical and current debate on applications and modelling can be differentiated as perspectives of modelling. Modelling is now one of the six general mathematical competencies defined in the educational standards for mathematics introduced in Germany in 2003, and there have been several initiatives to implement modelling in schools, as well as a whole range of empirical research projects focusing on teachers or students in modelling processes. As a special kind for implementing modelling into school, modelling weeks and days carried out by various German universities have been established.

Models and Modeling Perspectives

The First Sourcebook on Nordic Research in Mathematics Education: Norway, Sweden, Iceland, Denmark and contributions from Finland provides the first comprehensive and unified treatment of historical and contemporary research trends in mathematics education in the Nordic world. The book is organized in sections co-ordinated by active researchers in mathematics education in Norway, Sweden, Iceland, Denmark, and Finland. The purpose of this sourcebook is to synthesize and survey the established body of research in these countries with findings that have influenced ongoing research agendas, informed practice, framed curricula and policy. The sections for each country also include historical articles in addition to exemplary examples of recently conducted research oriented towards the future. The book will serve as a standard reference for mathematics education researchers, policy makers, practitioners and students both in and outside the Nordic countries.

The Second Handbook of Research on the Psychology of Mathematics Education

Since its establishment in 1976, PME (The International Group for the Psychology of Mathematics Education) is serving as a much sought after venue for scientific debate among those at the cutting edge of the field, as well as an engine for the development of research in mathematics education. A wide range of research activities conducted over the last ten years by PME members and their colleagues are documented and critically reviewed in this handbook, released to celebrate the Group's 40 year anniversary milestone. The book is divided into four main sections: Cognitive aspects of learning and teaching content areas; Cognitive aspects of learning and teaching transverse areas; Social aspects of learning and teaching mathematics; and Professional aspects of teaching mathematics. The selection for each chapter of a team of at least two authors, mostly located in different parts of the world, ensured effective coverage of each field. High quality was further enhanced by the scrupulous review of early chapter drafts by two leaders in the relevant field. The resulting volume with its compilation of the most relevant aspects of research in the field, and its emphasis on trends and future developments, will be a rich and welcome resource for both mature and emerging researchers in mathematics education.

Modeling Students' Mathematical Modeling Competencies

How we reason with mathematical ideas continues to be a fascinating and challenging topic of research—particularly with the rapid and diverse developments in the field of cognitive science that have taken place in recent years. Because it draws on multiple disciplines, including psychology, philosophy, computer science, linguistics, and anthropology, cognitive science provides rich scope for addressing issues that are at the core of mathematical learning. Drawing upon the interdisciplinary nature of cognitive science, this book presents a broadened perspective on mathematics and mathematical reasoning. It represents a move away from the traditional notion of reasoning as "abstract" and "disembodied", to the contemporary view that it is "embodied" and "imaginative." From this perspective, mathematical reasoning involves reasoning with structures that emerge from our bodily experiences as we interact with the environment; these structures extend beyond finitary propositional representations. Mathematical reasoning is imagined in the sense that it utilizes a number of powerful, illuminating devices that structure these concrete experiences and transform them into models (for abstract thought). These "thinking tools"—analogies, metaphors, metonymy, and imagery—play an important role in mathematical reasoning, as the chapters in this book demonstrate, yet their potential for enhancing learning in the domain has received little recognition. This book is an attempt to fill this void. Drawing upon backgrounds in mathematics education, educational psychology, philosophy, linguistics, and cognitive science, the chapter authors provide a rich and comprehensive analysis of mathematical reasoning. New and exciting perspectives are presented on the nature of mathematics (e.g., "mind-based mathematics"), on the array of powerful cognitive tools for reasoning (e.g., "analogies and metaphors"), and on the different ways these tools can facilitate mathematical reasoning. Examples are drawn from the reasoning of the preschool child to that of the adult learner.

Mathematics Education

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.

Resources in Education

Teaching and Learning Mathematical Modelling

"This book, aimed at precollege teachers, shows how the role of simulation modeling in investigation dynamic processes is now extending beyond research and university environments to the precollege world. Computer modeling has the potential to significantly improve the quality of secondary science and mathematics education. This book introduces teachers and students to many different perspectives of and approaches to scientific inquiry. Each of the chapters and associated software applications integrates mathematics, science, and technology in an authentic manner. The contributors discuss the issues raised by classroom-based modeling projects and provide most of the software applications described."--BOOK JACKET.Title Summary field provided by Blackwell North America, Inc. All Rights Reserved

Second Handbook of Research on Mathematics Teaching and Learning

Mathematical modelling is often spoken of as a way of life, referring to habits of mind and to dependence on the power of mathematics to describe, explain, predict and control real phenomena. This book aims to encourage teachers to provide opportunities for students to model a variety of real phenomena appropriately matched to students' mathematical backgrounds and interests from early stages of mathematical education. Habits, misconceptions, and mindsets about mathematics can present obstacles to university students' adoption of a "models-and-modelling perspective" at this stage of mathematics education. Without prior experience in building, interpreting and applying mathematical models, many students may never come to view and regard modelling as a way of life. The book records presentations at the ICTMA 11 conference held in Milwaukee, Wisconsin in 2003. Examines applications of modelling as a way of life, referring to habits of mind and dependence on the power of mathematics to describe, explain, predict and control real phenomena. Encourages teachers to provide students with opportunities to model a variety of real
Online Library Mathematics Education Models And Processes

Setting a Research Agenda

This survey provides a brief and selective overview of research in the philosophy of mathematics education. It asks what makes up the philosophy of mathematics education, what it means, what questions it asks and answers, and what is its overall importance and use? It provides overviews of critical mathematics education, and the most relevant modern movements in the philosophy of mathematics. A case study is provided of an emerging research tradition in one country. This is the Hermeneutic strand of research in the philosophy of mathematics education in Brazil. This illustrates one orientation towards research inquiry in the philosophy of mathematics education. It is part of a broader practice of ‘philosophical archaeology’; the uncovering of hidden assumptions and buried ideologies within the concepts and methods of research and practice in mathematics education. An extensive bibliography is also included.

The Philosophy of Mathematics Education

This book explores the option of building on symbolizing, modeling and tool use as personally meaningful activities of students. It discusses the dimension of setting: varying from the study of informal, spontaneous activity of students, to an explicit focus on instructional design, and goals and effects of instruction; and the dimension of the theoretical framework of the researcher: varying from constructivism, to activity theory, cognitive psychology and instructional-design theory.

Educational Algebra

In this volume, the authors address the development of students’ algebraic thinking in the elementary and middle school grades from curricular, cognitive, and instructional perspectives. The volume is also international in nature, thus promoting a global dialogue on the topic of early Algebraization.

Problem Solving in Mathematics Education

This book/software package brings the tools and excitement of modeling to pre-college teachers, to researchers involved in curriculum development, and to software developers interested in the pre-college market.

Attitudes, Beliefs, Motivation and Identity in Mathematics Education

This book of a detailed look into the how and what of mathematics instruction in Singapore. It presents multiple aspects of mathematics instruction in schools, ranging from the unique instructional core, practices that promote mastery, development of conceptual knowledge through learning experiences, nurturing of positive attitudes, self-regulation of learning and development and use of instructional materials, for making connections to mathematical ideas, developing mathematical reasoning, and developing fluency in applying mathematical knowledge in problem solving. The book presents a methodology that is successful in documenting classroom instruction in a comprehensive manner. The research findings illuminate instruction methods that are culturally situated, robust and proven to impact student learning. It demonstrates how a unique data source can be analyzed through multiple lenses and provides readers with a rich portrait of how the school mathematics instruction is enacted in Singapore secondary schools.

New Directions in Mathematics Education

This book records the state of the art in research on mathematics-related affect. It discusses the concepts and theories of mathematics-related affect along the lines of three dimensions. The first dimension identifies three broad categories of affect: motivation, emotions, and beliefs. The book contains one chapter on motivation, including discussions on how emotions and beliefs relate to motivation. There are two chapters that focus on beliefs and a chapter on attitude which cross-cuts through all these categories. The second dimension covers a rapidly fluctuating state to a more stable trait. All chapters in the book focus on trait-type affect and the chapter on motivation discusses both these dimensions. The third dimension regards the three main levels of theorizing: physiological (embodied), psychological (individual) and social. All chapters reflect that mathematics-related affect has mainly been studied using psychological theories.

Towards Gender Equity in Mathematics Education

To define better techniques of mathematics education, this book combines a knowledge of cognitive science with mathematics curriculum theory and research. The concept of the human reasoning process has been changed fundamentally by cognitive science in the last two decades. The role of memory retrieval, domain-specific and domain-general skills, analogy, and mental models is better understood now than previously. The authors believe that cognitive science provides the most accurate account thus far of the actual processes that people use in mathematics and offers the best potential for genuine increases in efficiency. As such, they suggest that a cognitive science approach enables constructivist ideas to be analyzed and further developed in the search for greater understanding of children’s mathematical learning. Not simply an application of cognitive science, however, this book provides a new perspective on mathematics education by examining the nature of mathematical concepts and processes, how and why they are taught, how and why mathematics provisioning models appear more effective than others, and how children might be assisted to become more mathematically powerful. The authors use recent theories of analogy and knowledge representation – combined with research on teaching practice – to find ways of helping children form links and correspondences between different concepts, so as to overcome problems associated with fragmented knowledge. In so doing, they have capitalized on new insights into the values and limitations of using concrete teaching aids which can be analyzed in terms of analogy theory. In addition to addressing the role of understanding, the authors have analyzed skill acquisition models in terms of their implications for the development of mathematical competence. They place strong emphasis on the development of students’ mathematical reasoning and problem solving skills to promote flexible use of knowledge. The book further demonstrates how children have a number of general problem solving skills at their disposal which they can apply independently to the solution of novel problems, resulting in the enhancement of their mathematical knowledge.

Mathematics Education in China: Its Growth and Development

Modeling Students' Mathematical Modeling Competencies offers welcome clarity and focus to the international research and professional community in mathematics, science, and engineering education, as well as those involved in the sciences of teaching and learning these subjects.

Mathematical Modelling

THE REAL WORLD OF MATHEMATICS, SCIENCE, AND TECHNOLOGY EDUCATION In this Preface, I would like to focus on what I mean by “education” and speak about the models and metaphors that are used when people talk, write, and act in the domain of education. We need to look at the assumptions and processes that the models and metaphors implicitly and explicitly contain. I feel we should explore whether there is a specific thrust to mathematics education in the here and now, and be very practical about it. For me, education is the enhancement of knowledge and understanding, and there is a strong and unbreakable link between the two. There seems little point in acquiring knowledge without understanding its meaning. Nor is it enough to gain a deep understanding of problems without gaining the appropriate knowledge to work for their solution. Thus knowledge and understanding are each necessary conditions for the process of education, but only when they are linked will the process bear fruit. Only in the connected interplay of knowledge and understanding can we hope to achieve genuine education.
Modeling and Simulation in Science and Mathematics Education

This special issue of Mathematical Thinking describes models and modeling perspectives toward mathematics problem solving, learning, and teaching. The concern is not only the mature forms of models and modeling in communities of scientists and mathematicians, but also the need to initiate students in these forms of thought. The contributions of this issue suggest a variety of ways that students (children through adults) can be introduced to highly productive forms of modeling practices. Collectively, they illustrate how modeling activities often lead to remarkable mathematical achievements by students formerly judged to be too young or too lacking in ability for such sophisticated and powerful forms of mathematical thinking. The papers also illustrate how modeling activities often create productive interdisciplinary niches for mathematical thinking, learning, and problem solving that involve simulations of similar situations that occur when mathematics is useful beyond school.

Reflective and Collaborative Processes to Improve Mathematics Teaching

This book documents the journey undertaken by educators from the Mathematics and Mathematics Education (MME) Academic Group in the National Institute of Education (NIE) and Singapore schools during a Mathematical Modelling Outreach (MMO) event in June 2010 under the guidance of renowned experts in the field of mathematical modelling. The main goal of MMO was to reach out to Singapore primary and secondary schools and introduce the potentials of mathematical modelling as a platform for eliciting mathematical thinking, communication, and reasoning among students. This book contributes to the expanding literature on mathematical modelling by offering voices from the Singaporean context. It suggests how theoretical perspectives on mathematical modelling can be transformed into actual practice in schools, all within the existing infrastructure of the current Singapore mathematics curriculum. More importantly, the book provides documentary evidence on how plans put in place through MMO in 2010 have since been realised. The publication of this book is hence timely at this juncture. Not only does the book record how MMO was among the first steps launched into the pond, it also serves as a bridge over which educators can stand upon to view how the ripple effect had developed from the initial MMO pebble and the directions it may continue to extend. Perhaps in the process, other ripples in the teaching, learning, and research of mathematical modelling can be created.


Keywords: Mathematical Modelling; Mathematical Modelling in Singapore; Mathematical Modelling in Singapore Schools; Mathematical Modelling Competencies; Mathematical Modelling Projects; Theoretical Perspectives on Mathematical Modelling; Mathematical Modelling Framework; Teacher Education in Mathematical Modelling; Key Features: This book discusses the use of mathematical modelling activities for teaching and learning in Singapore classrooms, drawing upon experiences from other countries provides focused discussions on the practicalities of conducting modelling activities in the classroom based on actual implementation in the Singapore context, drawing on the Singapore Mathematics Curriculum and other curricula also proposes the way forward in addressing the issue of mathematical modelling for teacher education and curricula planning in the Singapore context.

Tasks in Primary Mathematics Teacher Education

This survey addresses the use of technology in upper secondary mathematics education from four points of view: theoretical analysis of epistemological and cognitive aspects of activity in new technology mediated learning environments, the changes brought by technology in the interactions between environment, students and teachers, and the interrelationships between mathematical activities and skills and competencies that must be developed in teacher education. Research shows that the use of technology in mathematics education can have a significant impact on the learning processes. The question is which technologies to choose for which purposes, and how to integrate them, so as to maximize all students’ agency. In particular the role of the teacher in classrooms and the content of teacher education programs are critical for taking full advantage of technology in practice.

Critical Mathematics Education

This innovative text offers a unique approach to making mathematics education research on addition, subtraction, and number concepts readily accessible and understandable to pre-service and in-service teachers of grades K-3. Revealing students’ thought processes with extensive annotated samples of student work and vignettes characteristic of teachers’ experiences, this book provides educators with the knowledge and tools needed to modify their lessons and improve student learning of additive reasoning in the primary grades. Based on research gathered in the Ongoing Assessment Project (OGAP), this engaging, easy-to-use resource features practical resources such as: a close focus on student work, including annotated samples of student work, to help teachers improve their ability to recognize, assess, and monitor their students’ errors and misconceptions, as well as their developing conceptual understanding; A focus on the OGAP Additive Addition, Subtraction, and Base Ten Number Progressions, based on research conducted with hundreds of teachers and thousands of pieces of student work; In chapter sections on how Common Core State Standards for Math (CCSSM) are supported by math education research; End-of-chapter questions to allow teachers to analyze student thinking and consider instructional strategies for their own students; Instructional links to help teachers relate concepts from each chapter to their own instructional materials and programs; An accompanying eResource, available online, offers an answer key to Looking Back questions, as well as a copy of the OGAP Additive Framework and the OGAP Number Line Continuum. A Focus on Addition and Subtraction marks the fourth installment of the popular A Focus on collection, designed to aid the professional development of pre-service and in-service mathematics teachers. Following from previous volumes on ratios and proportions, multiplication and division, and fractions, this newest addition is designed to bridge the gap between what math education researchers know and what teachers need to know in order to better understand evidence in student work and make effective instructional decisions.

Word Problems

Tasks in Primary Mathematics Teacher Education is intended to advance relevant research and innovative international practices in the preparation and professional development of mathematics teachers. Emerging from discussion at the ICMI study on teacher professional development, this volume, focused on primary and elementary teachers, calls for a rich environment that can only be found by gathering wisdom from varied experiences around the world. The choice of tasks, and the associated pedagogies, is a key aspect of teaching and learning mathematics. Arguing that what students learn is largely defined by the tasks they are given, several major themes are presented. One such major strand, the forms, function and focus of tasks, is discussed throughout several chapters, offering analysis, discussion of implementation, and exemplars of a broader category of illustrative techniques for developing critical understanding.

Modeling and Simulation in Science and Mathematics Education

This survey book reviews four interrelated areas: (i) the relevance of heuristics in problem-solving approaches --- why they are important and what research tells us about their use; (ii) the need to characterize and foster creative problem-solving approaches — what type of heuristics helps learners devise and practice creative solutions; (iii) the importance that learners formulate and pursue their own problems, and (iv) the role played by the use of both multiple-purpose and ad hoc mathematical action types of technologies in problem-solving contexts -- what ways of reasoning learners construct when they rely on the use of digital technologies, and how technology and
technology approaches can be reconciled.

Mathematics Education and the Legacy of Zoltan Paul Dienes

This book takes a theoretical perspective on the study of school algebra, in which both semiotics and history occur. The Methodological design allows for the interpretation of specific phenomena and the inclusion of evidence not addressed in more general treatments. The book gives priority to "meaning in use" over "formal meaning". These approaches and others of similar nature lead to a focus on competence rather than a user's activity with mathematical language.