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PHILOSOPHY, LEARNING AND THE MATHEMATICS CURRICULUM

A reconstructive-comparative analysis of mathematics curriculums from China and the United States

Xuehui Xie, Zhejiang Normal University, China and **Phil Francis Carspecken**, Indiana University, USA

Mathematics curriculums used in progressive classrooms of the United States and in classrooms of the People's Republic of China presuppose markedly different philosophies. Xie and Carspecken reconstruct different assumptions operating implicitly within mathematics curriculums developed by the Ministry of Education in China and NCTM in the United States. Each curriculum is constructed upon a deep structure holistically integrating presuppositions about the nature of the human self, society, learning processes, language, concepts, human development, freedom, authority and the epistemology and ontology of mathematical knowledge. Xie and Carspecken next present an extended discussion of the two main philosophical traditions informing these curriculums: dialectical materialism in the case of the Chinese mathematics curriculum, and Dewey's instrumental pragmatism in the case of NCTM. Both philosophies were developed as movements out of Hegelian idealism while retaining the anti-dualist and anti-empiricist insights of Hegel's thought. The history of dialectical materialism and Dewey's instrumentalism is carefully examined by the authors to identify both similarities and sharp differences in the resulting mature philosophies. Drawing upon more recent philosophies of intersubjectivity (Brandom, Habermas) and dialectical materialist psychologies (Vygotsky, Luria), the authors conclude this book with arguments for overcoming the limitations of a purely instrumentalist framework and for expanding potentialities implicit within dialectical philosophies. This book will be of value to a broad audience, including mathematics educators, philosophers, curriculum theorists, social theorists, and those who work in comparative education and learning science.

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KEY WORKS IN RADICAL CONSTRUCTIVISM

(edited by Marie Larochelle)

Ernst von Glasersfeld

Key works on radical constructivism brings together a number of essays by Ernst von Glasersfeld that illustrate the application of a radical constructivist way of thinking in the areas of education, language, theory of knowledge, and the analysis of a few concepts that are indispensable in almost everything we think and do. Ernst von Glasersfeld's work opens a window on how we know what we know. The present work grew out of a desire to make more accessible this line of thought, to highlight its originality and consistency, and to illustrate its fecundity in the domains of cognition and learning.

The first three parts of this book contain texts by Glasersfeld that outline the constructivist approach and explicate the frequently drastic reconceptualizations he has suggested. Both the last part and the postscript consist of commentaries by Edith Ackermann, Jacques Désautels, Gérard Fourez, Leslie P. Steffe and Kenneth Tobin, scholars in the fields that Glasersfeld has been concerned with. They examine a number of critical aspects pertaining to (radical) constructivism's current and future development, often tracing out paths that warrant further exploration and reflection, in particular concerning the sociopolitical dimension of knowledge. Key works on radical constructivism is intended as a reference book for researchers, educators, and students of education—and for anyone interested in grasping, or deepening their grasp of, radical constructivism's tenets, ambitions and concerns. Readers will discover in this collection of firsthand contributions the contours of a bold, contemporary debate about a most compelling current of thought.

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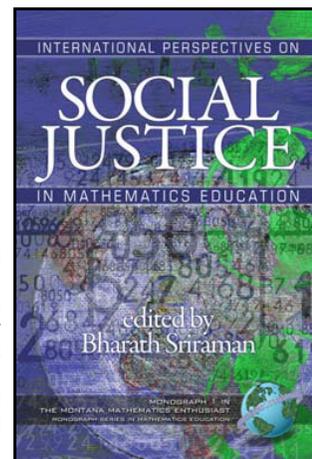
International Perspectives on Social Justice in Mathematics Education

Edited by **Bharath Sriraman**, *The University of Montana*

A Volume in **The Montana Mathematics Enthusiast:
Monograph Series in Mathematics Education**

Series Editor **Bharath Sriraman**, *The University of Montana*

International Perspectives and Research on Social Justice in Mathematics Education is the highly acclaimed inaugural monograph of The Montana Mathematics Enthusiast now available through IAP. The book covers prescient social, political and ethical issues for the domain of education in general and mathematics education in particular from the perspectives of critical theory, feminist theory and social justice research. The major themes in the book are (1) relevant mathematics, teaching and learning practices for minority and marginalized students in Australia, Brazil, South Africa, Israel, Palestine, and the United States., (2) closing the achievement gap in the U.K, U.S and Iceland across classes, ethnicities and gender, and (3) the political dimensions of mathematics. The fourteen chapters are written by leading researchers in the international community interested and active in research issues of equity and social justice.



"This book...is an astonishing collection of scholarly articles from all over the world offering a kaleidoscope of perspectives of tremendous importance to mathematics educators interested in our shared concern to create a saner, equitable and more peaceful society."

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Mathematics Education and the Legacy of Zoltan Paul Dienes

Edited by **Bharath Sriraman**, *The University of Montana*

A Volume in **The Montana Mathematics Enthusiast: Monograph Series in Mathematics Education**

Series Editor **Bharath Sriraman**, *The University of Montana*

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.

CONTENTS: Preface: The Legacy of Zoltan Paul Dienes, *Bharath Sriraman*. Reflections of Zoltan P. Dienes on Mathematics Education, *Bharath Sriraman and Richard Lesh*. Some Problems with Logic Blocks, *Suggested by Zoltan Dienes*. Logic Blocks to Other Embodiments, *Zoltan Paul Dienes*. Some Reflections on Order and Density: A Child's Path to the Bolzano-Weierstrass Theorem, *Zoltan Paul Dienes*. Games Leading to the Tetrahedron, *Zoltan Paul Dienes*. Cognitive Psychology and Mathematics Education: Reflections on the Past and the Future, *Lyn D. English*. The Impact of Zoltan Dienes on Mathematics Teaching in the United States, *James Hirstein*.

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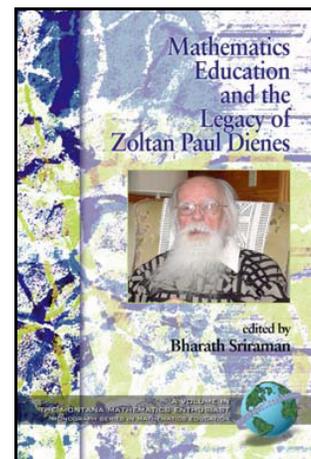
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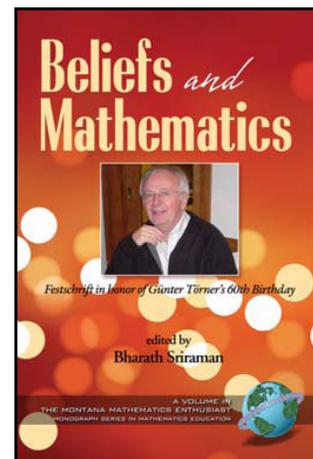
A Volume in **The Montana Mathematics Enthusiast:
Monograph Series in Mathematics Education**

Series Editor **Bharath Sriraman**, *The University of Montana*

Beliefs and Mathematics is a Festschrift honoring the contributions of Günter Törner to mathematics education and mathematics. Mathematics Education as a legitimate area of research emerged from the initiatives of well known mathematicians of the last century such as Felix Klein and Hans Freudenthal. Today there is an increasing schism between researchers in mathematics education and those in mathematics as evidenced in the Math wars in the U.S and other parts of the world. Günter Törner represents an international voice of reason, well respected and known in both groups, one who has successfully bridged and worked in both domains for three decades. His contributions in the domain of beliefs theory are well known and acknowledged.

The articles in this book are written by many prominent researchers in the area of mathematics education, several of whom are editors of leading journals in the field and have been at the helm of cutting edge advances in research and practice. The contents cover a wide spectrum of research, teaching and learning issues that are relevant for anyone interested in mathematics education and its multifaceted nature of research. The book as a whole also conveys the beauty and relevance of mathematics in societies around the world. It is a must read for anyone interested in mathematics education.

CONTENTS: Preface, *Bharath Sriraman*. Pictures of the Projective Plane, *Benno Artmann*. From Morphismsto Matrices, *Klaus Hoechsmann*. A Theory of Teaching and Its Applications, *Alan H. Schoenfeld*. Beliefs: What Lies Behind the Mirror? *Gilah C. Leder*. Political Issues in Mathematics Education, *Ubiratan D'Ambrosio*. Snapshots from the 1960s: Tensions and Synergies in the Emerging of New Trends in Mathematics Education, *Fulvia Furinghetti*. Matrizen Als Diagramme, *Lisa Hefendehl-Hebeker*. Mathematizing Definitions of Beliefs, *Norma Presmeg*. Integrating Oral Presentation into Mathematics Teaching and Learning: An Exploratory Study with Singapore Secondary Students, *Lianghuo Fan and Shu Mei Yeo*. The Role of Beliefs on Future Teacher's Professional Knowledge, *Gabriele Kaiser, Björn Schwarz, and Sebastian Krackowitz*. Girls' Beliefs about the Learning of Mathematics, *Guðbjörg Pálsdóttir*. Modelling in School: Chances and Obstacles, *Hans-Wolfgang Henn*. Complex Systems in the Elementary and Middle School Mathematics Curriculum: A Focus on Modeling, *Lyn D. English*. Attitude Toward Mathematics: Overcoming the Positive/Negative Dichotomy, *Rosetta Zan and Pietro Di Martino*. Subject-Related Education Management: Framework of a Professional Development Program and First Research, *Konrad Krainer and Florian H. Müller*. Integrating Intuition: The Role of Concept Image and Concept Definition for Students' Learning of Integral Calculus, *Bettina Rösken and Katrin Rolka*.



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HANDBOOK OF
INTERNATIONAL
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MATHEMATICS
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SECOND EDITION

EDITOR
LYN D. ENGLISH

ASSOCIATE EDITORS
MARIA BARTOLINI BUSSI
GRAHAM A. JONES
RICHARD A. LESH
BHARATH SRIRAMAN

Handbook of International Research in Mathematics Education

Second Edition

The Second Edition of the *Handbook of International Research in Mathematics Education* continues the mission of bringing together important new mathematics education research that makes a difference in both theory and practice. It updates and extends the *Handbook's* original key themes and issues for international research in mathematics education for the 21st century, namely:

- Priorities in international mathematics education research
- Lifelong democratic access to powerful mathematical ideas
- Advances in research methodologies
- Influences of advanced technologies

Each of these themes is examined in terms of learners, teachers, and learning contexts, with theory development being an important component of all these aspects.

This edition also examines other catalysts that have gained increased import in recent years including a stronger focus on the teacher and teacher practice, a renewed interest in theory development, an increased focus on the mathematics needed in work place settings, and a proliferation of research designs and methodologies that have provided unprecedented opportunities for investigating (and ultimately improving) mathematical teaching and learning.

Advancing the discipline by presenting dynamic, future-oriented works that address new and emerging priorities in mathematics education research, the Second Edition includes ten totally new chapters; all other chapters are thoroughly revised and updated. This is a must-have volume for scholars, professors, and graduate students in the field of mathematics education and in related areas such as educational psychology and educational research.

Lyn D. English is currently professor of mathematics education at the Queensland University of Technology, Australia. She is an elected Fellow of The Academy of the Social Sciences in Australia, and founding editor of *Mathematical Thinking and Learning: An International Journal*. Publications include *Mathematical and Analogical Reasoning of Young Learners*, the first edition of the *Handbook of International Research in Mathematics Education*, *Classroom Research in Mathematics: A Critical Examination of Methodology* (with Simon Goodchild), *Mathematical Reasoning: Analogies, Metaphors, and Images*, and *Mathematics Education: Models and Processes* (with Graeme Halford), and numerous book chapters, journal articles, conference papers, and special journal issues.

Handbook of International Research in Mathematics Education

Second Edition

Edited by
Lyn D. English

Associate Editors
Maria Bartolini Bussi
Graham A. Jones
Richard A. Lesh
Bharath Sriraman

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Preface

This second edition of the *Handbook of International Research in Mathematics Education* is intended for those interested in international developments and future directions in educational research, in particular, mathematics education research. The original edition (English, 2002) was prepared in response to a number of major global catalysts for change, including the impact of national and international mathematics comparative assessment studies; the social, cultural, economic, and political influences on mathematics education and research; the influence of enhanced sophistication and availability of technology; and the increased globalization of mathematics education and research.

Although our discipline has made considerable progress in the past decade, with significant theoretical and practical advances in many areas, the foregoing catalysts for change are still pertinent today, but with varying degrees of impact. Other catalysts have gained greater import in recent years including an increased focus on the teacher and teacher practice, a renewed interest in theory development in our discipline (e.g., semiotic mediation, which is the focus of a few chapters here), an increased focus on the mathematics needed in work place settings, and a proliferation of research designs and methodologies that have provided us with unprecedented opportunities for investigating (and ultimately improving) mathematical teaching and learning.

This second edition addresses the original priority themes and issues for international research in mathematics education for the 21st century, namely, life-long democratic access to powerful mathematical ideas, advances in research methodologies, and influences of advanced technologies. Each of these themes is examined in terms of learners, teachers, and learning contexts, with theory development being an important component of all these aspects. Some of the original chapters have been removed from this second edition and new chapters have been added (namely, chapters 4, 11, 18, 20, 25, 27, 28). Remaining original chapters have been updated, many quite substantially.

The volume comprises four sections. The first section, *Priorities in International Mathematics Education Research*, provides important background information on the key themes of the book, and also introduces new and emerging research trends in the field. Following my introductory chapter, Carol Malloy (chapter 2) explores democratic access to mathematics through democratic education, while Dylan Wiliam and Frank Lester (chapter 3) address the purpose of mathematics education research, and Cliff Konold and Richard Lehrer explore technology and mathematics education.

Section 2 focuses on *lifelong democratic access to powerful mathematical ideas* from the perspective of (a) learning and teaching, and (b) learning contexts and policy issues. With respect to learning and teaching, consideration is given to students' learning during the preschool and beginning school years (Bob Perry & Sue Dockett, chapter 5), the elementary and middle school years (Cynthia Langrall, Edward Mooney, Steven Nisbet, and Graham Jones, chapter 6), the secondary school years (Teresa Rojano, chapter 7), and finally, the advanced levels of mathematics education (Joanna Mamona-Downs & Martin Downs, chapter 8). Issues pertaining to representation

in mathematical learning and problem solving are addressed by Gerald Goldin in chapter 9. Research in preservice and inservice teacher education is explored in chapter 10 by Ruhama Even and Dina Tirosh, and in chapter 11 by João Pedro da Ponte and Olive Chapman.

The second component of section 2, namely, *learning contexts and policy issues*, covers a range of globally significant topics such as access and opportunity within the political and social context of mathematics education (Celia Rousseau and William Tate, chapter 13), democratic access to mathematical learning in a developing country (Luis Moreno-Armella and Manual Santos-Trigo, chapter 14), and a cultural psychology perspective on mathematical learning in out-of-school contexts (Guida de Gabreu, chapter 15). The complexities of change in mathematics education reform are addressed by Miriam Amit and Michael Fried in chapter 16, while Ole Skovsmose's and Paolo Valero's analysis of democratic access to powerful mathematical ideas completes the section.

In section 3, the chapters focus on *advances in research methodologies*. In chapter 18 Alan Schoenfeld explores the numerous past, current, and possible future trends in conceptual frameworks and paradigms used in mathematics education research. Margret Hjalmarson and Richard Lesh consider design research with a focus on engineering, systems, products, and processes for innovation. The importance of linking research with practice is also emphasized in this section, in particular, in the chapters by Nicolina Malara and Rosetta Zan (chapter 20), Kenneth Ruthven and Simon (chapter 21), and Douglas Clements (chapter 22). In chapter 25, Fulvia Furinghetti and Luis Radford discuss how the pedagogical use of the history of mathematics can serve as a means to transform teaching. The section concludes with Bharath Sriraman's and Günter Törner's survey and analysis of different traditions in mathematics education research within Europe particularly in Germany, France, and Italy (chapter 25).

In the final section, the *influences of advanced technologies on mathematical learning and teaching are investigated*. These chapters also include substantial theoretical development in relation to technology and mathematics education. Chapter 26, by Jim Kaput, Richard Noss, and Celia Hoyles looks at developments of new notations for mathematics learning in the computational era. This chapter has not been altered from its original version, given the tragic passing of Jim Kaput in 2005. The ideas presented in the chapter are as relevant, powerful, and future-oriented as they were in the first edition. New chapters in this section include those by Ferdinando Arzarello and Ornella Robutti (chapter 27), who address an embodied mind approach within a multimodal paradigm, and Maria Bartolini Bussi and Maria Alessandra Mariotti, (chapter 28), who provide insights into semiotic mediation in the mathematics classroom. In the remaining chapters, Michal Tabach, Rina Hershkowitz, Tommy Dreyfus, and Abraham Arcavi (chapter 29) present a research-design view of computerized environments in mathematics classrooms, Michal Yerushalmy and Danile Chazan (chapter 30) look at technology and curriculum design with a focus on the ordering of discontinuities in school algebra, and Rosa Bottino and Giampaolo Chiappini (chapter 31) explore advanced technology and learning environments with a focus on their relationships within the arithmetic problem-solving domain.

The concluding chapter (32) addresses some of the key 21st century issues in the advancement of mathematics education and mathematics education research. These include, among others, interdisciplinary debates on the powerful mathematical ideas students need to succeed in today's world, calls for research to support more equitable mathematics curriculum and learning access for all students and to find more effective ways of creating learning environments that can increase such learning access, and the need to improve teacher education and development to achieve our goal of powerful mathematics for all. The concluding chapter also reviews the broadening of research designs and methodologies in our discipline, which are providing strong bases for advancing the learning and teaching of mathematics.

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