

## Preface

Public concern over the readiness of United States' students to compete in an ever globalized market is often linked to their preparation in mathematics. Other concerns voice questions about teachers' knowledge and the overall capability of schools to motivate and educate our youth. Underlying these conversations and questions about the state of mathematics education in the United States is the quality of mathematics curricula available and the quality of teacher education programs in mathematics. Both of these concerns are directly related to the experiences these teachers have and what they learned about students' acquisition of mathematical knowledge as a result of their experience and university programs. In the end, the structure and content of university programs in mathematics education will be influenced in most cases by individuals with doctorates in mathematics education. To what degree are these professionals prepared to design and provide both knowledge of mathematics education and mathematics content to pre- and in-service teachers? To what extent are these professionals able to work with mathematicians in shaping high quality programs for pre- and in-service teachers of mathematics? To what degree are these professionals prepared to guide students in designing, delivering, and evaluating learning experiences? To what degree are these professionals prepared to conjecture about and conduct research focused on answering questions arising from the learning and teaching of mathematics? To what extent are these professionals prepared to communicate relevant research in mathematics education to teachers, parents and politicians? To what extent are these professionals prepared to become active players in shaping policy that impacts students and teachers? To what extent are these professionals prepared to work in careers beyond higher education, including district and state mathematics supervisors, commercial publishers, and test developers?

It was to answer such questions that the Second National Conference on Doctoral Programs in Mathematics Education was held in Kansas City, MO in September 2007. A copy of the program is included in Appendix A. Over 150 participants (See Appendix B) representing 90 different institutions from over 40 states in the USA, as well as Japan, Norway and Spain attended. The institutions represented produced more than 70 percent of all doctoral graduates in mathematics education from institutions of higher education in the USA from 2000 to 2005. Participants represented mathematics, mathematics education, and curriculum and instruction departments from the participating universities.

The present program followed up on a Conference on Doctoral Programs in Mathematics Education held in 1999. That Conference revealed a wide variety of

doctoral programs as well as a growing shortage of doctorates in mathematics education. Keynote presentations, along with issues raised and plans for action were captured in the publication of *One Field, Many Paths: U. S. Doctoral Programs in Mathematics Education* (Reys & Kilpatrick, 2001). Since the 1999 Conference a number of events have occurred, some related to the Conference and others independent. However, all have influenced the trajectory of change in doctoral programs in mathematics education. These events include:

- The Conference stimulated the Association of Mathematics Teacher Educators (AMTE) to include in their website ([www.amte.net](http://www.amte.net)) information about doctoral programs in mathematics education. This website posts information about doctoral programs in mathematics education from more than 60 different institutions. The site is dynamic to allow institutions to update information, and for new institutions to provide information about their doctoral program in mathematics education.
- The Conference also stimulated the AMTE to appoint a Task Force to consider the formulation of common core elements for doctorates in mathematics education. A document entitled *Principles to Guide the Design and Implementation of Doctoral Programs in Mathematics Education* was developed and later published by the AMTE. This document remains available at the AMTE website.
- The AMTE and the National Council of Teachers of Mathematics issued a joint statement related to the *Principles to Guide the Design and Implementation of Doctoral Programs in Mathematics Education*. This statement remains available at [www.amte.net](http://www.amte.net) and [www.nctm.org](http://www.nctm.org)
- In 2000, the National Science Foundation, partially in response to the growing shortage of doctorates in mathematics education, began to establish Centers for the Learning and Teaching that were designed to help develop the infrastructure and strengthen the capacity of doctoral preparation in mathematics and science education. The following centers were established with a specific focus on mathematics education:
  - Appalachian Collaborative Center for Learning, Assessment and Instruction in Mathematics (ACCLAIM)-University of Tennessee, University of Louisville, University of Kentucky, Ohio University, University of West Virginia
  - Center for the Mathematics Education of Latinos (CEMELA)-University of Arizona, University of New Mexico, University of California-Santa Cruz, University of Illinois-Chicago
  - Center for Teaching and Learning in the West (CLT-West)-Montana State University, University of Montana, Colorado State University, University of Northern Colorado, Portland State University
  - Center for Proficiency in Teaching Mathematics (CPTM)-University of Georgia, University of Michigan
  - Center for the Study of Mathematics Curriculum (CSMC)-University of Missouri, Michigan State University, University of Western Michigan, University of Chicago
  - Diversity in Mathematics Education (DIME)-University of Wisconsin, University of California-Berkeley, University of California-Los Angeles, Vanderbilt University

- Mid-Atlantic Center for Mathematics Teaching and Learning (MAC-MTL)-University of Maryland, University of Delaware, Penn State University
- Center for Mathematics in America's Cities (Metro Math)-Rutgers, University of Pennsylvania, City University of New York
- In 2000 the Carnegie Initiative on the Doctorate (CID) was started and included a careful examination of doctoral preparation in various disciplines. Among other products of the CID was the publication of *Envisioning the Future of Doctoral Education: Preparing Stewards of the Discipline* (Golde & Walker, 2006) and *The Formation of Scholars: Rethinking Doctoral Education for the Twenty-first Century* (Walker, Golde, Jones, Bueschel & Hutchings, 2008).
- In 2007 the American Statistical Association published *Using Statistics in Mathematics Education Research* and the Education School Project published *Educating Researchers* by Arthur Levine. These documents are a reminder that multiple groups are focusing on doctoral preparation, and offering ideas and resources of interest to faculty engaged in doctoral programs in mathematics education.
- In 2000 the National Council of Teachers of Mathematics released *Principles and Standards for School Mathematics* and further elaborated on its contents with their 2006 publication *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics: A Quest for Coherence*. These publications, in combination with a number of national and international studies on the state of the mathematics curriculum for example, *The Intended Mathematics Curriculum as Represented in State-Level Curriculum Standards: Consensus or Confusion* (B. Reys, 2006), brought a national focus on the mathematical education of teachers of mathematics and those that provide university experiences for them.

The work of the CLTs and their resulting products, together with a flurry of activity focusing on doctoral programs, provided an excellent backdrop for this Second National Conference on Doctoral Programs in Mathematics Education.

An Advisory Panel composed of John Dossey, Department of Mathematics, Illinois State University (emeritus); Jim Fey, Departments of Mathematics and Mathematics Education, University of Maryland; W. James Lewis, Department of Mathematics and Statistics, University of Nebraska; Vena Long, Professor of Mathematics Education, University of Tennessee; Sid Rachlin, Professor of Mathematics Education, East Carolina University, Barbara and Robert Reys, Professors of Mathematics Education, University of Missouri, and James Wilson, Professor of Mathematics Education, University of Georgia; and doctoral students, Nevels Nevels, University of Missouri; Dawn Teuscher, University of Missouri; and Catherine Ulrich, University of Georgia was established. Robert Glasgow, Southwest Baptist University, served as an external evaluator. Members of the Advisory Panel met in September 2006 to formulate plans for the conference themes and possible speakers.

The Conference was organized around several major questions:

What constitutes core knowledge for doctoral students in mathematics education?

What are some issues and challenges in delivering doctoral programs in mathematics education?

What can we learn about doctoral preparation from other countries?

Would accreditation of doctoral programs in mathematics education strengthen our profession?

What next steps need to be addressed in doctoral preparation?

The Conference program was organized to address these issues in large group sessions. Smaller Breakout Sessions provided opportunities to address some selected issues in more depth. The Conference program (Appendix A) identifies the themes and leaders in mathematics education that provided either keynote addresses or led the Breakout Sessions.

This book *U. S. Doctorates in Mathematics Education: Developing Stewards of the Discipline* contains papers prepared prior to and presented during the Conference. Three background papers developed prior to the Conference provide a backdrop for the conference. The first paper provides a glimpse of the history of doctoral programs in mathematics education since 1960, reporting information about the number of graduates and the institutions that prepared them. A survey was made of doctoral programs and students currently in doctoral programs in mathematics education, and results from those surveys are reported in the other two papers. All participants had an opportunity to read these papers prior to the Conference.

The Conference included several keynote addresses, smaller Breakout Sessions and two panel discussions. The keynote addresses provided a broad view of the landscape, and were followed by discussions in organized Breakout Sessions that focused on some specific aspects of doctoral programs. Given the interest in international comparisons taking place within public education and building on a similar session in the first Doctoral Conference in 1999, a panel discussion reflecting an international glimpse of doctoral preparation provided an opportunity to examine how doctoral programs function in other countries and cultures. Another discussion section focused on different perspectives regarding whether accreditation of doctoral programs would provide guidance to the development of doctoral programs or potentially stifle innovation in doctoral programs in mathematics education.

The next-to-last section contains three unsolicited papers. One provides a perspective from several doctoral students that participated in the Conference. Another is from a young faculty member reflecting on his doctoral preparation in light of his new position as an assistant professor in a research extensive university. The third paper is from two faculty members addressing the specific challenge of designing a doctoral program in mathematics education for students without a strong mathematics background.

The final section contains a commissioned paper providing a reflection on the Conference. It offers possible next steps in the continuing process of improving doctoral programs in mathematics education.

To all conference participants, we express our thanks for your contributions. (Appendix B provides a list of all Conference participants.) To all contributors of papers, we say thanks for taking the time and care to record your thoughts so that issues, ideas, and suggestions offered during the Conference have an opportunity to reach a broader audience. A special thanks to all of the Advisory Panel for their behind the scenes work that contributed to the success of the conference.

Finally we thank the National Science Foundation for providing the financial support for the project, including John (Spud) Bradley, our project officer. This Conference was funded by the National Science Foundation but the positions taken and opinions expressed in this volume do not reflect any endorsement by the National Science Foundation.

We also thank the Conference Board of the Mathematical Sciences for reviewing the manuscript and offering suggestions for improving the papers. A special thanks to Oscar Chávez and Dan Ross for their technical help, and to Kristin Judd for her work in preparing this book for publication. We hope *U. S. Doctorates in Mathematics Education: Developing Stewards of the Discipline* will both inform and stimulate the continuing dialogue that will assist institutions in their continuing efforts to improve and strengthen their doctoral programs in mathematics education.

*Robert Reys*  
*University of Missouri*  
*Columbia, MO 65211*  
*reysr@missouri.edu*

*John Dossey*  
*Illinois State University*  
*Eureka, IL 61530*  
*jdossey@ilstu.edu*