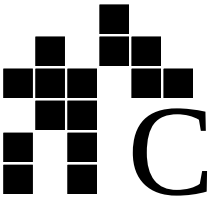

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One Field, Many Paths: U. S. Doctoral Programs in Mathematics Education

Robert E. Reys
Jeremy Kilpatrick
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PREFACE

The first doctorates in mathematics education in the United States were awarded in the early years of the twentieth century. By the end of the century, more than 100 U.S. institutions were offering such doctorates, and between 50 and 115 doctorates were being awarded annually with mathematics education as their major area. In some instances, the institution offered a specific doctoral program in mathematics education, but in many others, the program was more general—such as general education, curriculum and instruction, or mathematics—and mathematics education might be only one of several possible specializations within it. Many of the mathematics education doctoral programs were located in departments of mathematics—particularly in institutions that had begun as teachers colleges—but the great majority were to be found in schools or colleges of education.

As the century ended, employment opportunities in mathematics education were expanding, and there was a severe shortage of qualified applicants for new faculty positions. University mathematics departments were seeking mathematics educators not only to teach courses in mathematics or mathematics education for teachers but also to conduct research into the teaching and learning of undergraduate mathematics. School districts and state departments of education were seeking mathematics educators for their staffs who could lead projects in curriculum development, professional development, and assessment. The question of what preparation a doctoral program in mathematics education could and should provide candidates for these new positions was becoming increasingly knotty.

As a field that straddles the liberal arts and the professions, mathematics education has always had a blurred institutional identity. It is not surprising, therefore, that doctoral studies in the field take many forms. Although from time to time, particularly in the last three decades, surveys have been conducted of U.S. doctoral programs in mathematics education, there has been little in the way of up-to-date, substantive information on those programs, and no information on proposed new programs or planned changes in programs.

To begin the process of examining, discussing, and making recommendations for doctoral programs in mathematics education, a National Conference on Doctoral Programs in Mathematics Education was held in October 1999 at Lake Ozark, Missouri. It was funded by a grant from the National Science Foundation and was preceded by a year of preparation that included a comprehensive survey of programs.

Both the survey and the conference were designed and conducted under the direction of an organizing committee. The committee met in Atlanta in October 1998 to provide

ideas for the survey and suggestions for the conference themes and speakers. Members of the committee were F. Joe Crosswhite, The Ohio State University (emeritus); Elizabeth Fennema, University of Wisconsin (emerita); Joan Ferrini-Mundy, Michigan State University; Martin Johnson, University of Maryland; Jeremy Kilpatrick, University of Georgia; Mary Lindquist, Columbus State University; Pat Thompson, Vanderbilt University; and James Wilson, University of Georgia. The survey was conducted in the spring of 1999 by Robert Reys, Bob Glasgow, Gay Ragan, and Ken Simms, all at the University of Missouri.

The conference was designed to provide a dialogue regarding

- the nature of current doctoral programs in mathematics education,
- ways of strengthening such programs, and
- suggestions and guidelines for faculty engaged in restructuring an existing program or creating a new one.

The conference was by invitation only. Invitations were sent to one faculty member from each of the institutions identified by the survey as among the 30 largest U.S. producers of doctorates in mathematics education. Representatives from 43 institutions participated, and these institutions accounted for about 60 percent of the doctorates in mathematics education awarded during the last 20 years. Invitations were also extended to faculty members involved in establishing recent doctoral programs in mathematics education at their institutions; to individuals with perspectives on non-U.S. programs; and to others representing organizations such as the National Council of Teachers of Mathematics, the National Council of Supervisors of Mathematics, the Mathematical Association of America, the American Mathematical Association of Two-Year Colleges, the Association of Mathematics Teacher Educators, and the National Science Foundation. A complete list of participants is provided in Appendix A.

Before the conference, the participants were sent a draft of the survey results. One conference session was devoted to a discussion of those results and their implications. Other conference sessions focused on the genesis of U.S. doctoral programs, major program components, the match between preparation and employment, challenges in developing new and revising existing programs, doctoral programs from an international perspective, and actions to be taken as a consequence of the conference. Groups of participants discussed preparation in research, in mathematics, in mathematics education, and in teaching. Discussions were also held on the changing nature of dissertations, program features beyond course work, distance learning, and recruiting and funding doctoral students. In addition to scheduled presentations, the conference was organized to encourage and facilitate informal discussions.

One Field, Many Paths: U.S. Doctoral Programs in Mathematics Education, the first organized collection to focus specifically on doctoral programs in mathematics education, contains papers prepared for the conference as well as papers submitted afterward. The papers have been reviewed, edited, and organized into five sections dealing with background information on programs, core components of programs, issues, reactions and reflections, and ideas for future action. The “Background” provides different perspectives of doctoral programs in mathematics education. The papers in “Core Components” highlight elements that are common in most doctoral programs, including course work as well as experiences that go beyond courses. A range of other

issues surfaced during the conference, such as recruitment and organizing new programs, and these issues constitute part three, “Related Issues.” Some thoughts from participants after the conference are included in “Reactions and Reflections.” The final section, “Ideas for Action,” includes a single paper that provides a brief synthesis of the conference and offers suggestions for future action.

The “Background” includes the initial keynote presentation by Eileen Donoghue that highlighted the evolution of doctoral programs in the United States. This is followed by a summary of survey results by Robert Reys, Bob Glasgow, Gay Ragan and Ken Simms that provides information about institutions and doctoral graduates since 1980, as well as some data on faculty and program requirements. Mathematics educators (Diane Briars, Terry Crites, Skip Fennell, Susan Gay, and Harry Tunis) whose careers have taken them in different directions reflect on the match between their current position and their doctoral preparation. An international perspective of doctoral preparation in mathematics education by Alan Bishop (Australia) serves as a reminder that the model for doctoral programs in the United States is not reflected in many other countries.

Jim Fey uses broad strokes to highlight core elements of doctoral programs and sets the stage for the remaining papers within the “Core Components.” Four core areas are addressed, including mathematics content (John Dossey and Glenda Lappan); research (Tom Carpenter and Frank Lester); mathematics education (Norma Presmeg and Sigrid Wagner); and teaching (Diana Lambdin and Jim Wilson). Research leading to a doctoral dissertation is a common element of every doctoral program. Lee Stiff highlights some ways that dissertations are changing. Quality doctoral programs provide opportunities for professional growth and development beyond course work, and some of these options are highlighted by Glen Blume.

Additional issues surfaced during the conference, and these are addressed in “Related Issues.” For example, some institutions (East Carolina University, Portland State University, San Diego State University, Illinois State University and Montclair State University) are initiating new doctoral programs in mathematics, and faculty from those institutions (Robert Hunting, Mike Shaughnessy, Judy Sowder, Carol Thornton, Ken Wolff) share some problems and challenges associated with establishing new programs. Other institutions (Oklahoma State University, Stanford University, Rutgers University, University of Mississippi and George Mason University) are revamping their existing programs; Doug Aichele, Jo Boaler, Carolyn Maher, David Rock and Mark Spikell highlight ways these programs are evolving. Recruiting and supporting doctoral students is a common concern for all programs, and approaches used in different institutions are summarized by Ken Wolff. Program outreach to serve non-resident students is another major issue, and distance learning has the potential to address this need. Charles Lamb discusses distance learning and provides some suggestions. Richard Lesh, Janel Crider and Edith Gummer propose a model for collaborative doctoral programs in mathematics education that involve multiple campuses as well as distance learning.

“Reactions and Reflections” includes participants’ thoughts on different issues, including policy (Vena Long), challenges of small doctoral programs in mathematics education (Jenny Bay), implications for new programs (Alfinio Flores), why an international student chose to enter a doctoral program in the U.S. (Thomas Lingefjärd), and personal reflections from a doctoral student participating in the conference (Gay Ragan).

At the closing session, participants identified several prevalent themes that surfaced during the conference. There was clear consensus on the need for more information about doctoral programs in mathematics education. A more controversial issue related to the need for and value of guidelines for such programs. Although no consensus was reached, there was agreement that this issue was important and needed further deliberation. The paper in the "Ideas for Action" by Jim Hiebert, Jeremy Kilpatrick and Mary Lindquist reflects on the conference discussions, and offers ideas for action that will continue the dialogues established at the conference and lead to the improved quality of doctorates in mathematics education.

To all the conference participants, we express our gratitude for the many thoughtful ideas and suggestions that were proposed. This publication allows some of that information to be communicated to a broader audience. We are especially grateful, therefore, to those participants who contributed papers in this volume. We recognize the many demands on their time and appreciate their willingness to share their knowledge and experience. A special thanks to Bob Glasgow, Gay Ragan and Tim Sanders (doctoral students at that time) for their willingness to assume a range of tasks and duties that contributed to the success of the conference, and their contributions to the development of this volume, and to Sara Priddy for graphic design.

Finally, we thank the National Science Foundation for providing the financial support for the project and the Conference Board of the Mathematical Sciences for making the conference papers available through this publication. We hope *One Field, Many Paths: U.S. Doctoral Programs in Mathematics Education* will stimulate discussion and prove useful in preparing future recipients of doctorates in mathematics education.

Robert E. Reys
121 Townsend Hall
University of Missouri
Columbia, MO 65211
reysr@missouri.edu

Jeremy Kilpatrick
105 Aderhold Hall
University of Georgia
Athens, GA 30602-7124
jkilpat@coe.uga.edu