Conference Board of the Mathematical Sciences

Issues in Mathematics Education

Volume 15

U.S. Doctorates in Mathematics Education

Developing Stewards of the Discipline

Robert E. Reys
John A. Dossey
Editors

American Mathematical Society
in cooperation with
Mathematical Association of America

U.S. Doctorates in Mathematics Education

Developing Stewards of the Discipline

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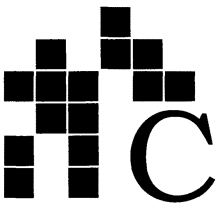

CBMS

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Robert E. Reys
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American Mathematical Society
Providence, Rhode Island
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Mathematical Association of America
Washington, D. C.

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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) 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 and 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.

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Appendix B: Conference Agenda

Sunday, September 23

4:00 pm	Registration	Foyer
5:00-6:15	Opening Session: *Doctoral Programs in Mathematics Education: A Look at What's Happening* Bob Reys, University of Missouri	Ballroom
6:15-7:00	Dinner	
7:00-8:00	Keynote Session: *Creating a broader vision of doctoral education: Lessons from the Carnegie Initiative on the Doctorate* Chris Golde, Carnegie Foundation/Stanford University Session Presider: Sid Rachlin, East Carolina University	

Monday, September 24 (Theme - Core Knowledge of Mathematics Education)

8:30-9:30	Keynote Session: *What core knowledge do doctoral students in mathematics education need to know?* Joan Ferrini-Mundy, Michigan State University/NSF Session Presider: Barbara Reys, University of Missouri	Ballroom
9:30-10:00	Break	
10:00-11:30	Breakout Sessions (Topics and Facilitators): *Mathematics* Dan Chazan, University of Maryland Jim Lewis, University of Nebraska *Curriculum* Chris Hirsch, Western Michigan University Rose Zbiek, Penn State University *Policy* Ed Silver, University of Michigan Erica Walker, Teachers College, Columbia University *Teaching* Megan Franke, University of California-Los Angeles Pat Wilson, University of Georgia *Diversity* Rick Kitchen, University of New Mexico Edd Taylor, University of Wisconsin *Technology* Kathy Heid, Penn State University Hollylynne Stohl Lee, North Carolina State University	Salon F-G Seville II Seville I Westport Plaza Millcreek (3rd Floor)
11:30-1:00	Lunch	Ballroom
1:00-2:30	Breakout Sessions (repeat of earlier sessions)	(as above)
2:30-3:00	Break	
3:00-4:30	Panel: *Preparing Doctorates in Mathematics Education: An International Perspective* Moderator: Jeremy Kilpatrick, University of Georgia Panelists: Bea DAmbrosio, Miami University, USA Barbro Grevholm, Agder University College, Norway and Director of Nordic Center Masataka Koyama, Hiroshima University, Japan Luis Rico Romero, University of Granada, Spain	Ballroom

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Tuesday, September 25 (Theme - Program Delivery: Issues and Strategies)

8:30-9:30	Keynote Session: *Program Delivery Issues, Challenges and Opportunities* Denise Mewborn, University of Georgia Session Presider: Jim Wilson, University of Georgia	Ballroom
9:30-10:00	Break	
10:00-11:30	Breakout Sessions (Topics and Facilitators): *Preparation of Researchers* Barbara Dougherty, University of Mississippi Jim Middleton, Arizona State University *Doctoral Program Components* Bill Bush, University of Louisville Enrique Galindo, Indiana University *Online Delivery of Doctoral Courses* Maurice Burke, Montana State University Vena Long, University of Tennessee *Doctoral Program Elements for Part-Time Students* Jerry Goldin, Rutgers University Gladis Kersaint, University of South Florida *Induction of Doctoral Graduates into the Profession* Gwen Lloyd, Virginia Tech University Barbara Reys, University of Missouri	 Salon F-G Seville II Seville I Westport Plaza
11:30-1:00	Lunch	Ballroom
1:00-2:30	Breakout Sessions (repeat of earlier sessions)	(as above)
2:30-3:00	Break	
3:00-4:30	Reception and Poster Session: *Ideas from the Field*	Foyer

Wednesday, September 26

8:30-9:30	Panel: *Accreditation of Doctoral Programs in Mathematics Education* Moderator: Glenda Lappan, Michigan State University Panelists: Jenny Bay-Williams, University of Louisville Jere Confrey, North Carolina State University Skip Fennell, McDaniel College Mark Klespis, Sam Houston State University	Ballroom
9:30-10:00	Break	
10:00-11:00	*Reflections on conference discussions* Jim Hiebert, University of Delaware Diana Lambdin, Indiana University Steve Williams, Brigham Young University	Ballroom
11:00-11:30	*Closing Session, next steps* Jim Hiebert, University of Delaware Bob Reys, University of Missouri	Ballroom

References

American Statistical Association. (2007). *Using statistics effectively in mathematics education research.* Washington, DC: Author.

Apple, M. (1992). Do the standards go far enough? Power, policy, and practice in mathematics education. *Journal for Research in Mathematics Education, 23*(5), 412-431.

Association of Mathematics Teacher Educators. (2003). *Principles to guide the design and implementation of doctoral programs in mathematics education.* San Diego, CA: Author.

Ball, D. L. (2003, February). *What mathematical knowledge is needed for teaching mathematics.* Paper presented at the U.S. Department of Education Secretary's Mathematics Summit, Washington, DC.

Ball, D. L. & Forzani, F. M. (2007). What makes education research "educational"? *Educational Researcher, 36*(9), 529-540.

Ball, D. L., Hill, H., & Bass, H. (Fall, 2005). Knowing mathematics for teaching: Who knows mathematics well enough to teach third grade, and how can we decide? *American Educator*, 14-22, 43-46.

Banks, J. A., Cochran-Smith, M., Moll, L., Richert, A., Zeichner, K., & LePage, P. (2005). Teaching diverse learners. In L. Darling-Hammond & J. D. Bransford (Eds.), *Preparing teachers for a changing world* (pp. 232-275). San Francisco: John Wiley & Sons.

Bass, H. (2006). Developing scholars and professionals: The case of mathematics. In C. M. Golde & G. E. Walker (Eds.), *Envisioning the future of doctoral education: Preparing stewards of the discipline. Carnegie essays on the doctorate* (pp. 101-119). San Francisco, CA: Jossey-Bass.

Berliner, D. C. (2006). Toward a future as rich as our past. In C. M. Golde & G. E. Walker (Eds.), *Envisioning the future of doctoral education: Preparing stewards of the discipline. Carnegie essays on the doctorate* (pp. 268-289). San Francisco, CA: Jossey-Bass.

Bishop, A. (2001). Doctoral programs in mathematics education: Features, options and challenges. In R. Reys & J. Kilpatrick (Eds.), *One field, many paths: U. S. doctoral programs in mathematics education* (pp. 55-62). Providence, RI: American Mathematical Society.

Blume, G. (2001). Beyond course experiences: The role of non-course experiences in mathematics education doctoral programs. In R. Reys & J. Kilpatrick, (Eds.), *One field,*

many paths: U. S. doctoral programs in mathematics education (pp. 87-94). Providence, RI: American Mathematical Society.

Blume, G. W., & Heid, M. K. (Eds.). (In press). *Research on technology in the learning and teaching of mathematics: Syntheses and perspectives. Vol. II.* Charlotte, NC: Information Age Publishing, Inc.

Boaler, J. (2002). Learning from teaching: Exploring the relationship between reform curriculum and equity. *Journal for Research in Mathematics Education, 33*(4), 239-258.

Boaler, J. (2006). Promoting respectful learning. *Educational Leadership, 63*(5), 74-78.

Board on Mathematical Sciences. (1997). *Preserving strength while meeting challenges: Summary report of a workshop on actions for the mathematical sciences.* Washington DC: National Academy Press.

Bottge, B. A. (1999). Effects of contextualized math instruction on problem solving of average and below-average achieving students. *Journal of Special Education, 33*(2), 81-92.

Bransford, J. D., Brown, A. L., & Cocking, R. R. (Eds.). (2000). *How people learn: Brain, mind, experience, and school.* Washington DC: National Academy Press.

CAPES (Coordenaçño de Aperfeiçoamento de Pessoal de Nível Superior - *Agency for the Improvement of Human Resources in Higher Education*). Brasilia, Brazil: Ministry of Education. Information on specific aspects of programs is available at:
Recommended programs–http://www.capes.gov.br/avaliacao/recomendados.html
Program evaluation criteria–
http://www.capes.gov.br/avaliacao/criterios/avaliacao_trienal_2007.html
In country scholarships–http://www.capes.gov.br/bolsas/nopais/
Study abroad scholarships–http://www.capes.gov.br/bolsas/noexterior/

Centers for Learning and Teaching Network (CLTNet). (2006). *Centers for learning and teaching: Building the nation's leadership in science, technology, engineering, and mathematics education.* Arlington, VA: SRI International.

Chan, T. F. (2006). A time for change? The mathematics doctorate. In C. M. Golde & G. E. Walker (Eds.), *Envisioning the future of doctoral education: Preparing stewards of the discipline. Carnegie essays on the doctorate* (pp. 120-134). San Francisco, CA: Jossey-Bass.

Chazan, D., Sword, S., Badertscher, E., Conklin, M., Graybeal, C., Hutchison, P., Marshall, A. M., & Smith, T. (2007). Learning to Learn Mathematics: Voices of Doctoral Students in Mathematics Education. In M. Strutchens & W. Gary Martin (Eds.) *The Learning of Mathematics.* 69th Yearbook of the National Council of Teachers of Mathematics (pp. 367-379). Reston, VA: NCTM.

Civil, M. & Andrade, R. (2002). Transitions between home and school mathematics: Rays of hope amidst the passing clouds. In G. de Abreu, A. J. Bishop, & N. C. Presmeg (Eds.), *Transitions between contexts of mathematical practices* (pp. 149-169). Boston, MA: Kluwer.

CNPQ (Conselho Nacional de Desenvolvimento Científico e Tecnológico - *National Council of Scientific and Technological Development*). Brasilia, Brazil: Ministry of Science of

Technology. Information available at: http://www.cnpq.br/cnpq/index.htm

Council of Graduate Schools. (2007). *Mission statement of the Council of Graduate Schools.* Washington, DC: Author. Available at: http://www.cgsnet.org/

Cuoco, A., Goldenberg, E., & Mark, J. (1996). Habits of mind: An organizing principle for mathematics curricula. *Journal of Mathematical Behavior, 15*, 375-402.

Dossey, J., & Lappan, G. (2001). The mathematics education of mathematics educators in doctoral programs in mathematics education. In R. Reys & J. Kilpatrick (Eds.), *One field, many paths: U. S. doctoral programs in mathematics education* (pp. 67-72). Providence, RI: American Mathematical Society.

Duke, N. K., & Beck, S. W. (1999). Education should consider alternative formats for the dissertation. *Educational Researcher, 28*(3), 31-36.

Eisenhart, M., & DeHaan, R. L. (2005). Doctoral preparation of scientifically based education researchers. *Educational Researcher, 34*(4), 3-13.

European University Association. (2005). *Doctoral programs for the European knowledge society. Results of EUA doctoral programs project.* Brussels, Belgium: Author. Available at: http://www.eua.be/fileadmin/user_upload/files/EUA1_documents/
Doctoral Programs_Project_Report.1129278878120.pdf

Even, R. (1993). Subject-matter knowledge and pedagogical content knowledge: Prospective secondary teachers and the function concept. *Journal for Research in Mathematics Education, 24*(2), 94-116.

Ewing, J. (Ed.). (1999). *Towards excellence: Leading a doctoral mathematics department in the 21st century.* Providence, RI: American Mathematical Society.

Ferrini-Mundy, J., & Floden, R. E. (2007). Educational policy research and mathematics education. In F. K. Lester (Ed.) *Second handbook of research on mathematics teaching and learning* (pp. 1247-1279). Charlotte, NC: Information Age Publishing.

Ferguson, R. F. (1998). Teachers' perceptions and expectations and the Black-White test score gap. In C. Jencks & M. Phillips (Eds.), *The Black-White test score gap*, (pp. 273-317). Washington, DC: The Brookings Institution.

Fernádez-Cano, A., Torralbo, M., and Vallejo, M. (2007). Análisis longitudinal de las tesis doctorales españolas en pedagogía (1976-2006). In F. Etxeberría (Ed.). *Actas del XIII° Congreso Nacional de Modelos de Investigación Educativa* (pp. 829-832). San Sebastián: Associatión Interuniversitaria de Investigación Pedagógica (AIDIPE).

Fey, J. T. (2001). Doctoral programs in mathematics education: Features, options, and challenges. In R. E. Reys & J. Kilpatrick, *One field, many paths: U. S. doctoral programs in mathematics education* (pp. 55-62). Providence, RI: American Mathematics Society.

Freudenthal, H. (1983). *Didactical phenomenology of mathematical structures.* Dordrecht, The Netherlands: D. Reidel Publishing Company.

Fry, R. (2007). *The changing racial and ethnic composition of U.S. public schools.* Washington, DC: Pew Hispanic Center.

Glasgow, R. (2000). *An investigation of recent graduates of doctoral programs in mathematics education*, Unpublished doctoral dissertation, University of Missouri-Columbia, Columbia, Missouri.

Goldberger, M., Maher, B., & Flattau, P. (1995). *Research-doctorate programs in the United States: Continuity and change.* Washington, DC: National Academy Press.

Golde, C. M. (2006). Preparing stewards of the discipline. In C. M. Golde & G. E. Walker (Eds.), *Envisioning the future of doctoral education: preparing stewards of the discipline. Carnegie essays on the doctorate* (pp. 3-20). San Francisco, CA: Jossey-Bass.

Golde, C. M. (2007). Signature pedagogies in doctoral education: Are they adaptable for the preparation of education researchers? *Educational Researcher, 36*(6), 344-351.

Golde, C. M., Bueschel, A. C., Jones, L., & Walker, G. E. (in press). Apprenticeship and intellectual community: Lessons from the Carnegie initiative on the doctorate. In R. Ehrenberg & C. Kuh (Eds.), *Doctoral education and the faculty of the future.* Ithaca, NY: Cornell University Press.

Golde, C. M. & Walker, G. E. (2006). *Envisioning the future of doctoral education: Preparing stewards of the discipline.* San Francisco, CA: Jossey-Bass.

Grant, C. A. (1989). Equity, equality, teachers and classroom life. In W. G. Secada (Ed.), *Equity in education* (pp. 89-102). London: Falmer Press.

Gravemeijer, K. (1994). *Developing realistic mathematics education.* Utrecht, The Netherlands: Vakroep Onderzoek Wiskundeonderwijs en Onderwijscomputer-centrum, Rijksuniversiteit.

Graybeal, C. D. (2007). Whole number multiplication: There's more to it than might be expected! *Mathematics Teacher, 101*(4), 312-316.

Green, J., Camilli, G., & Elmore, P. (Eds.). (2006). *Handbook of complementary perspectives for education research.* Washington, DC: AERA

Grevholm, B. (2004a). A Nordic Graduate School in mathematics education starts in 2004. *Nordic Studies in Mathematics Education, 9*(1), 75-76.

Grevholm, B. (2004b). What are the needs for doctoral students in mathematics education? *Nordic Studies in Mathematics Education, 9*(3), 67-69.

Grevholm, B. (2004c). New courses in mathematics education for doctoral students. *Nordic Studies in Mathematics Education, 9*(4), 65-67.

Grevholm, B. (2005a). Activities in the Nordic Graduate School of mathematics education during 2005. *Nomad, 10*(1), 57-59.

Grevholm, B. (2005b).The third year of activities in the Nordic Graduate School in mathematics education. *Nomad, 10*(3-4), 101-104.

Grevholm, B. (2006a). The Nordic Graduate School in mathematics education. Summer school of 2006. *Nordic Studies in Mathematics Education, 11*(2), 71-74.

Grevholm, B. (2006b). Continued activities for the Nordic Graduate School. *Nordic Studies in Mathematics Education, 11*(3), 85-88.

Grevholm, B. (2006c). New dissertations in mathematics education by doctoral students in the Nordic Graduate School. *Nordic Studies in Mathematics Education, 11*(1), 75-78.

Grevholm, B., Persson, L. E., & Wall, P. (2005). A dynamic model for education of doctoral students and guidance of supervisors in research groups. *Educational Studies in Mathematics, 60*(2), 173-197.

Grouws, D. A. (Ed.) (1992). *Handbook of research on mathematics teaching and learning.* New York: Macmillan.

Guin, D., Ruthven, K., & Trouche, L. (Eds.). (2005). *The didactical challenge of symbolic calculators: Turning a computational device into a mathematical instrument.* New York, NY: Springer.

Gutstein, E. (2005). *Reading and writing the world with mathematics: Toward pedagogy for social justice.* New York, NY: Routledge Falmer.

Gutiérrez, K. D., Baquedano-López, P., & Tejada, C. (2000). Rethinking diversity: Hybridity and hybrid language practices in the third space. *Mind, Culture, and Activity, 6*(4), 286-303.

Hartnett, R. T. (1976). Environments for advanced learning. In J. Katz & R. T. Hartnett (Eds.), *Scholars in the making: The development of graduate and professional students* (pp. 49-84). Cambridge, UK: Ballinger Publishing.

Hiebert, J., Kilpatrick, J., & Lindquist, M. M. (2001). Improving U. S. doctoral programs in mathematics education. In R. E. Reys & J. Kilpatrick (Eds.), *One field, many paths: U. S. doctoral programs in mathematics education* (pp. 153-159). Providence, RI: American Mathematical Society.

Heid, M. K., & Blume, G. W. (Eds.). (In press) *Research on technology in the learning and teaching of mathematics: Syntheses and perspectives, Vol. I.* Charlotte, NC: Information Age Publishing, Inc.

Heid, M. K. & Zembat, I. (2007, April). *Representational and Object Understanding of Mathematical Entities: The Case of Function.* Paper presented at the annual meeting of the American Educational Research Association, Chicago, IL.

Hiroshima University. (2007). *Handbook of Graduate School of Education.* (In Japanese). Hiroshima, Japan. Available at: http://www.hiroshima-u.ac.jp/ed/daigakuin/

Hollebrands, K., & Zbiek, R. (2004). Teaching mathematics with technology: An evidence-based road map for the journey. In R. Rubenstein & G. Bright (Eds.), *Perspectives on the Teaching of Mathematics* (pp.259-270). Reston, VA: National Council of Teachers of Mathematics.

Hoyles, C., & Noss, R. (2003). What can digital technologies take from and bring to research in mathematics education. In A. J. Bishop, K. Clements, C. Keitel, J. Kilpatrick, & F. K. S. Leung (Eds.), *Second international handbook of mathematics education, Part One* (pp. 323-349). Dordrecht, The Netherlands: Kluwer.

Hyogo University of Teacher Education. (2007). *Handbook of Joint Graduate School (Ph. D. program) in Sciences of School Education.* (In Japanese). Hyogo, Japan: Author. Available at: http://www.office.hyogo-u.ac.jp/jgs/

Ingersoll, R. M. (2007). Teaching science in the 21st Century. The science and mathematics teacher shortage: Fact and myth. *NSTA News Digest.* Available at http://www.nsta.org/publications/news/story.aspx?id=538

Jones, L., Lindzey, G., & Coggeshall, P. E. (1982). *An assessment of research-doctorate programs in the United States.* Washington, DC: American Council on Education.

Kaput, J. (1992). Technology and mathematics education. In D. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 515-556). New York, NY: MacMillan.

Kieran, C., & Yerushalmy, M. (2004). Research on the role of technological environments in algebra learning and teaching. In K. Stacey, H. Chick, M. Kendal (Eds.), *The future of the teaching and learning of algebra* (pp. 99-152). Boston, MA: Kluwer.

Kilpatrick, J., Rico, L., & Sierra, M. (1994). *Educación matemática e investigación.* Madrid, Spain: Editorial Síntesis.

Knapp, M. S., & Woolverton, S. (1995). Social class and schooling. In J. Banks & C. Banks (Eds.), *Handbook of research on multicultural education* (pp. 548-569). New York: Macmillan.

Knuth, E. J. (2002). Secondary school mathematics teachers' conceptions of proof. *Journal for Research in Mathematics Education, 33*(5), 379-405.

Koehler, M. J., & Mishra, P. (2005). What happens when teachers design educational technology? The development of technological pedagogical content knowledge. *Journal of Educational Computing Research, 32*(2), 131-152.

Krathwohl, D. (1994). A slice of advice. *Educational Researcher, 23*(1), 29-32, 42.

Labaree, D. F. (2003). The peculiar problems of preparing educational researchers. *Educational Researcher, 32*(4), 13-22.

Ladson-Billings, G. (1997). It doesn't add up: African American students' mathematics achievement. *Journal for Research in Mathematics Education, 28*(6), 697-708.

Ladson-Billings, G. (2001). *Crossing over to Canaan: The journey of new teachers in diverse classrooms.* San Francisco: Jossey-Bass Publishers.

Lambdin, D. V., & Wilson, J. W. (2001). The teaching preparation of mathematics educators in doctoral programs in mathematics education. In R. E. Reys & J. Kilpatrick (Eds.), *One field, many paths: U. S. doctoral programs in mathematics education* (pp.

77-83). Providence, RI: American Mathematical Society.

Lave, J. (1996). Teaching, as learning, in practice. *Mind, Culture, and Activity, 3*, 149-164.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* Cambridge, UK: Cambridge University Press.

Leder, G. C., Brandell, G., & Grevholm, B. (2004). The Swedish graduate school in mathematics education: Conception, birth and development of a new doctoral programme. *Nordic Studies in Mathematics Education, 9*(2), 165-182.

Lee, H. S. (2005). Facilitating students' problem solving: Prospective teachers' learning trajectory in a technological context. *Journal of Mathematics Teacher Education, 8*(3), 223-254.

Lesh, R., Crider, J. A., & Gummer, E. (2001). Emerging possibilities for collaborating doctoral programs. In R. E. Reys and J. Kilpatrick, *One field, many paths: U. S. doctoral programs in mathematics education* (pp. 113-128). Providence, RI: American Mathematics Society.

Lester, F. K. (Ed.). (2007). *Second handbook of research on mathematics teaching and learning.* Charlotte, NC: Information Age Publishing.

Lester, F. K. & Carpenter, T. P. (2001). Research preparation of doctoral students in mathematics education. In R. E. Reys & J. Kilpatrick (Eds.), *One field, many paths: U.S. doctoral programs in mathematics education* (pp. 63-66). Providence, RI: American Mathematics Society.

Lester, F. K., & Lambdin, D. (2003). The ship of Theseus and other metaphors for thinking about what we value in mathematics education research. In J. Kilpatrick & A. Sierpinska (Eds.), *Mathematics education as a research domain: A search for identity* (pp. 415-425). Dordrecht, The Netherlands: Kluwer.

Levine, A. (2007). *Educating researchers.* Report #2. Education Schools Project. Princeton, NJ: Woodrow Wilson Foundation. Available at: http://www.edschools.org/

Lipka, J. (2005). Math in a cultural context: Two case studies of a successful culturally based math project. *Anthropology & Education Quarterly, 36*(4), 367-385.

March, J. (2002). Foreward. In D. Cattani (Ed.), *A classroom of her own: How new teachers develop instructional, professional, and cultural competence* (pp. xi-xiv). Thousand Oaks, CA: Corwin Press.

Marshall, A. M. (2008). *Opportunities to practice what we preach: Mathematical experiences of mathematics education doctoral students.* Unpublished doctoral dissertation. University of Maryland, College Park, MD.

Ministerio de Educación y Ciencia (2006). *Propuesta: La organización de la enseñanza universitaria en España.* Madrid, Spain: Author. Available at: http://www.mec.es/educa/ccuniv/html/documentos/Propuesta.pdf

Moschkovich, J. N. (1999). Supporting the participation of English language learners in mathematical discussions. *For the Learning of Mathematics, 19*, 11-19.

Moschkovich, J. N. (2002). A Situate and sociocultural perspective on Bilingual mathematics learners. *Mathematical Thinking and Learning, 4*(2&3), 189-212.

Moses, R., & Cobb Jr., C. (2001). *Radical equations: Math literacy and civil rights.* Boston: Beacon Press.

Murray, J., & Male, T., (2005). Becoming a teacher educator: Evidence from the field. *Teaching and Teacher Education, 21*, 125-142.

National Center for Education Information (2005). *Profile of teachers in the U.S.* Washington, DC: Author.

National Commission on Excellence in Education. *A Nation At Risk.* Washington, D.C.: U.S. Department of Education, 1983.

National Council of Teachers of Mathematics. (1980). *An agenda for action.* Reston, VA: Author.

National Council of Teachers of Mathematics. (1989). *Curriculum and evaluation standards for school mathematics.* Reston, VA: Author.

National Council of Teachers of Mathematics (2000). *Principles and standards for school mathematics.* Reston, VA: Author.

National Council of Teachers of Mathematics. (2006). *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics.*, VA: Author.

National Education Association. (1894). *Report of the Committee of Ten on secondary school studies with the reports of the conferences arranged by the committee.* New York: American Book Company.

National Mathematics Advisory Panel. (2008). *Foundations for Success: The Final Report of the National Mathematics Advisory Panel.* Washington, DC: United States Department of Education. As of March 2008, available at: www.ed.gov/about/bdscomm/list/mathpanel/index.html

National Opinion Research Center (NORC). (2006). *Summary reports: Doctoral recipients from United States universities-1960-2005.* Chicago, IL: Author.

National Research Council. (1989). *Everybody Counts: A report to the nation on the future of mathematics education.* Washington DC: National Academy Press.

National Research Council. (2005). *Advancing scientific research in education.* Washington, DC: National Academies Press.

National Science Foundation. (2007). *Integrative Graduate Education and Research Traineeship Program (IGERT). Program Solicitation 07-540.* Available at: http://www.nsf.gov/pubs/2007/nsf07540/nsf07540.htm

National Science Foundation, Division of Science Resources Statistics. (2006). *U.S. doctorates in the 20th century.* NSF 06-319. Arlington, VA: NSF.

Neiss, M. L. (2005). Preparing teachers to teach science and mathematics with technology: Developing a technology pedagogical content knowledge. *Teaching and Teacher Education, 21*, 509-523.

Niss, M. (1999). Aspects of the nature and state of research in mathematics education. *Educational Studies in Mathematics, 40*, 1-24.

Oakes, J. (1990). *Multiplying inequalities: The effects of race, social class, and tracking on opportunities to learn mathematics and science.* Santa Monica, CA: RAND.

Oakes, J., Franke, M., Quartz, K. H., & Rogers, J. (2002). Research for high-quality urban teaching: Defining it, developing it, assessing it. *Journal of Teacher Education, 53*, 228-234.

Presmeg, N. C., & Wagner, S. (2001). Preparation in mathematics education: Is there a basic core for everyone? In R. E. Reys and J. Kilpatrick, *One field, many paths: U. S. doctoral programs in mathematics education* (pp. 73-76). Providence, RI: American Mathematics Society.

Public Agenda. (2007). *Important, but not for me: Parents and students in Kansas and Missouri talk about math, science, and technology education.* New York, NY: Public Agenda.

PUC-SP (Catholic University at São Paulo). Sao Paulo, Brazil: Author. Available at: http://www.pucsp.br/pos/edmat/

Reys, B. (Ed.). (2006). *The Intended Mathematics Curriculum as Represented in State-Level Curriculum Standards: Consensus or Confusion*, Charlotte, NC: Information Age Publishing.

Reys, R. E. (2000). Doctorates in mathematics education: An acute shortage. *Notices of the American Mathematical Society, 47*(10), 1267-1270.

Reys, R. E. (2002). Mathematics education positions in higher education and their applicants: A many to one correspondence. *Notices of the American Mathematical Society, 49*(2), 202-207.

Reys, R. E. (2006). A report on jobs for doctorates in mathematics education in institutions of higher education. *Journal for Research in Mathematics Education, 37*(4), 262-269.

Reys, R. E., Glasgow, B., Ragan, G.A., & Simms, K. W. (2001). Doctoral programs in mathematics education in the United States: A status report. In R. E. Reys & J. Kilpatrick (Eds.), *One Field, Many Paths: U. S. Doctoral Programs in Mathematics Education* (pp. 19-40). Providence, RI: American Mathematical Society.

Reys, R., Glasgow, R., Teuscher, D., & Nevels, N. (2007). Doctoral programs in mathematics education in the United States: 2007 status report. *Notices of the American Mathematical Society, 54*(11), 1283-1293.

Reys, R., & Kilpatrick, J. (Eds.). (2001). *One field, many paths: U.S. doctoral programs in mathematics education.* Providence, RI: American Mathematical Society.

Richardson, V. (2006). Stewards of a field, stewards of an enterprise: The doctorate in education. In C. M. Golde & G. E. Walker (Eds.), *Envisioning the future of doctoral education: Preparing stewards of the discipline. Carnegie essays on the doctorate* (pp. 251-267). San Francisco, CA: Jossey-Bass.

Rodriguez, A. J. & Kitchen, R. S. (Eds.) (2005). *Preparing mathematics and science teachers for diverse classrooms: Promising strategies for transformative pedagogy.* Mahwah, NJ: Lawrence Erlbaum Associates.

Schifter, D. (1998). Learning mathematics for teaching: From a teachers' seminar to the classroom. *Journal of Mathematics Teacher Education, 1*(1), 55-87.

Schoenfeld, A. H. (1988). When good teaching leads to bad results: The disasters of "well-taught" mathematics courses. *Educational Psychologist, 23*(2), 145-166.

Schoenfeld. A. H. (1999). The core, the cannon, and the development of research skills: Issues in the preparation of education researchers. In E. Lagemann & L. Shulman (Eds.), *Issues in education research: Problems and possibilities* (pp. 166-202). New York, NY: Jossey-Bass.

Sfard, A., & Linchevski, L. (1994). The gains and the pitfalls of reification–the case of algebra. *Educational Studies in Mathematics, 26*, 191-228.

Sierpinska, A. (2003). Research in mathematics education through a keyhole. In E. Simmt & B. Davis (Eds.), Canadian Mathematics Education Study Group: Proceedings 2003 (pp. 13-35). Edmonton, Alberta, Canada: CMESG. Available at: http://publish.edu.uwo.ca/cmesg/

Society for Research on Educational Effectiveness. *Mission statement.* Ithaca, NY: Author. Available at: http://www.educationaleffectiveness.org/

Stiff, L. V. (2001). Discussions on different forms of doctoral dissertations. In R. E. Reys & J. Kilpatrick, *One field, many paths: U. S. doctoral programs in mathematics education* (pp. 85-86). Providence, RI: American Mathematical Society.

Tate, W. F. & Rousseau, C. (2007). Engineering change in mathematics education: Research, policy, and practice. In F. K. Lester (Ed.). *Second Handbook of Research on Mathematics Teaching and Learning* (pp. 1209-1246). Charlotte, NC: Information Age Publishing.

Tokyo Gakugei University. (2007). *Handbook of United Graduate School* [Ph. D. program) in Sciences of School Education, Document in Japanese.]. Tokyo, Japan: Author. Available at: http://www.u-gakugei.ac.jp/09daigakuin/07rengo.html

UNESP- Rio Claro (State University of São Paulo in Rio Claro). Rio Claro, Brazil: Author. Available at: http://www.rc.unesp.br/igce/matematica/pedu/apres_matematica.html

UNICAMP (State University of Campinas - State of São Paulo). Campinas, Brazil: Author. Available at: http://www.posgrad.fae.unicamp.br/inf_gerais_frame.html

USP (University of São Paulo). Sao Paulo, Brazil: Author.
Available at: http://www3.fe.usp.br/pgrad/

University of Tsukuba. (2007). *Handbook of Graduate School of Comprehensive Human Sciences.* [In Japanese]. Tsukuba, Japan: Author.
Available at: http://www.tsukuba.ac.jp/organization/doctoral.html

Vergnaud, G. (1988). Multiplicative structures. In J. Hiebert & M. Behr (Eds.), *Number concepts and operations in the middle grades* (pp. 141-161). Reston, VA: National Council of Teachers of Mathematics. Hillsdale, NJ: Lawrence Erlbaum Associates.

Walbesser, H. H. & Eisenberg, T. (1971), What research competencies for the mathematics educator? *American Mathematics Monthly, 58*, 667-73.

Walker, G. E., Golde, C. M., Jones, L., Bueschel, A. C., & Hutchings, P. (2008). *The formation of scholars: Rethinking doctoral education for the 21st Century.* San Francisco, CA: Jossey-Bass.

Wenger, E. (1998). *Communities of practice: Learning, meaning and identity.* Cambridge, MA: Cambridge University Press.

Wiggins, G., & McTighe, J. (1998). *Understanding by design.* Alexandria, VA: Prentice Hall.

Wilson, J. (2003). Mathematics education: A personal perspective. In G. Stanic & J. Kilpatrick (Eds.), *A history of school mathematics* (Vol. 2, pp. 1779-1807). Reston, VA: National Council of Teachers of Mathematics.

Wilson, P., Bismarck, S., & DuCloux, K. (2006, April). Relationships that foster learning within a student teaching experience. Paper presented at the annual meeting of the American Educational Association, San Francisco, CA.

Wittrock, M. C. (Ed.). (1986). *Handbook of research on teaching.* New York: MacMillan

Zaslavsky, O., & Leikin, R. (2004). Professional development of mathematics teacher educators: Growth through practice. *Journal of Mathematics Teacher Education, 7*, 5-32.

Zbiek, R. M., Heid, M. K., Blume, G. W., & Dick, T. P. (2007). Research on technology in mathematics education: The perspective of constructs. In F. Lester (Ed.), *Second handbook of research on mathematics teaching and learning* (pp. 1169-1207). Greenwich, Connecticut: Information Age Publishing, Inc.

Zbiek, R., & Hollebrands, K. (in press). A research-informed view of the process of incorporating mathematics technology into classroom practice by inservice and prospective teachers. In M. K. Heid & G. Blume (Eds.) *Research on technology in the learning and teaching of mathematics: Syntheses and perspectives. Vol. I.* Charlotte, NC: Information Age Publishing, Inc.

Zeichner, K. M. (1996). Educating teachers to close the achievement gap: Issues of pedagogy, knowledge, and teacher preparation. In B. Williams (Ed.), *Closing the achievement gap: A vision for changing beliefs and practices* (pp. 56-76). Alexandria, VA: Association for Supervision and Curriculum and Development.

Mathematics education in the United States will be shaped at all levels by those who hold doctorates in the field. As professors, they influence the structure and content of university programs in mathematics education, where future teachers are prepared. As scholars, they engage in research and lead us to a deeper and better understanding of the field. This book is a detailed study of doctoral programs in mathematics education. It stems from a national conference sponsored by the National Science Foundation. It involved participants from across the United States, as well as Brazil, Japan, Norway, and Spain, and followed up the work of an earlier conference, published in *One Field, Many Paths: U.S. Doctoral Programs in Mathematics Education* (Volume 9 in this series).

The book, as was the conference, is organized around several major questions, including: What is the core knowledge for doctoral students in mathematics education? What are the important issues and challenges in delivering doctoral programs? What can we learn about doctoral preparation by comparisons with other countries? What effect would accreditation of doctoral programs in mathematics education have on the profession? What next steps need to be addressed now?

The book documents the wide range of ideas about doctoral programs in mathematics education and their varied features. It provides readers with current visions and issues concerning doctoral studies in the field and serves as a reminder that establishing stewards of the discipline of mathematics education is a continuing challenge.

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