Program Book

www.nctm.org/researchconf
NCTM Research Committee

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University of Missouri

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• The Research Conference will be held at the Westin – Boston Waterfront hotel.
• Registration will be held in Grand Ballroom Foyer. **Registration is required for attendance, and badges must be worn for all sessions.**
  - Monday, 4:00 p.m.–7:30 p.m.
  - Tuesday, 7:30 a.m.–3:00 p.m.
• On Wednesday, the Research Conference is open to all registered attendees of the NCTM Annual Meeting and the NCSM Annual Conference. Badges from these conferences will be required for attendance for all sessions on Wednesday.
• A light reception will be held on Monday evening in the Grand Ballroom Foyer from 8:30 p.m. to 10:00 p.m. following the opening session at 7:00 p.m. in Grand Ballroom A/B.
• Two sets of Research Posters Sessions will take place in Grand Ballroom C/D
  - 5:45 p.m.–6:45 p.m. on Monday
  - 5:00 p.m.–6:00 p.m. on Tuesday
• The Call for Proposals for the 2016 NCTM Research Conference in San Francisco, California, will be available online by early June 2015.
• The NCTM Bookstore will be open on Wednesday 10:00 a.m. – 7:00 p.m in the Exhibit Hall.

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Invited Sessions

Opening Session

William Penuel and Catherine Martin

Design-Based Implementation Research as a Strategy for Expanding Opportunity to Learn in School Districts (Session 29.1)
Monday, April 7th, 7:00 p.m.–8:15 p.m.
Grand Ballroom A/B

Early Mathematics with Mobile Technology: A Research-Practice Collaboration (Session 31)
Tuesday, April 14, 8:30 a.m. – 9:45 a.m.
Grand Ballroom B

Engaging US Researchers with the International Commission on Mathematical Instruction (Session 40)
Tuesday, April 14, 10:00 a.m. – 11:15 a.m.
Otis

Research on the Digital Revolution in Mathematics Curriculum, Teaching and Learning (Session 45)
Tuesday, April 14, 10:00 a.m. – 11:15 a.m.
Webster

Using Date Mining for Real Time Assessment and Tutoring Inquiry Skills (Session 67)
Tuesday, April 14, 1:15 p.m. – 2:30 p.m.
Faneuil

Grand Challenges in Mathematics Education (Session 81)
Tuesday, April 14, 3:30 p.m. – 4:45 p.m.
Grand Ballroom A

Researchers as Mathematics Teacher Educators: Developing MTE Manuscripts from Research (Session 85)
Tuesday, April 14, 3:30 p.m. – 4:45 p.m.
Faneuil

Research on Mathematical Reasoning in Informal Designed Learning Environments (Session 86)
Tuesday, April 14, 3:30 p.m. – 4:45 p.m.
Webster

Crafting a Dissertation-Based Research Article for JRME (Session 107)
Wednesday, April 15, 8:30 a.m. – 9:45 a.m.
Grand Ballroom A/B

2015 Linking Research and Practice IPS Session (Session 111)
Wednesday, April 15, 8:30 a.m. – 9:45 a.m.
Otis

Writing Research for Teachers: Putting Results into Practice (Session 113)
Wednesday, April 15, 8:30 a.m. – 9:45 a.m.
Grand Ballroom E

Plenary Session

Deborah Loewenberg Ball, Danny B Martin, Dan Meyer, and Steven Leinwand

Turning the Common Core into Reality in Every Math Class (Session 113.1)
Wednesday, April 9th, 10:00 AM – 11:15 AM
Grand Ballroom A/B

Life of a MET Grant: Space for Progressive Math Pedagogy (Session 121)
Wednesday, April 15, 12:30 p.m. – 1:00 p.m.
Commonwealth Ballroom B

National Science Foundation Funding Program Overview and Proposal Writing (Session 122)
Wednesday, April 15, 12:30 p.m. – 1:00 p.m.
Grand Ballroom A/B

Graduate Student, Junior Faculty, and Researcher Mentoring Session (Session 131)
Wednesday, April 15, 1:15 PM – 2:30 PM
Commonwealth Ballroom C
The Westin
Boston Waterfront
Welcome!

On behalf of Research Committee of the National Council of Teachers of Mathematics (NCTM) and the Special Interest Group/Research in Mathematics Education of the American Educational Research Association, we welcome you to NCTM’s Research Conference. The Research Conference serves multiple purposes. First, it brings researchers together annually to examine and discuss current issues in mathematics education. Second, it provides an opportunity for researchers to receive feedback on their work and to benefit from exposure to alternative points of view. Third, it affords beginning scholars opportunities to interact and network with veteran researchers in the field. Finally, it allows the field to capitalize on the collective wisdom available when researchers and practitioners come together to discuss mathematics education and research.

The Research Conference continues to receive many high quality proposals from the community. This year we received 433 proposals and were able to accept 175 sessions for the final program, giving an overall acceptance rate of 40.4%. The conference program also includes several invited sessions highlighting topics and new trends relevant to the field. Additionally, this year we are hosting Meeting Place sessions to encourage more informal networking and interaction.

We would like to thank the members of NCTM’s Research Committee, members of the executive board for the SIG/RME, and other members of the research community who served as reviewers. Your work is greatly valued and appreciated. Moreover, we would like to thank the staff at NCTM for helping us with the logistics of the conference, registration, printing the program, and so on. We would like to thank all the presenters for their strong proposals and their willingness to share their work. Finally, we would like to thank everyone in attendance, and we hope that you will find the conference stimulating and enjoyable. We are glad you are here.

Sincerely,
Kathryn Chval
NCTM Research Committee, Chair

Paola Sztajn
AERA SIG/RME Co-Chair

Janine Remillard
AERA SIG/RME Co-Chair

Michael Fish
NCTM Research Committee, Staff Liaison

Opening Session—Monday, 7:00 p.m.

William Penuel and Catherine Martin

Design-Based Implementation Research as a Strategy for Expanding Opportunity to Learn in School Districts (Session 29.1)
Monday, April 7th, 7:00 p.m.—8:15 p.m.

Grand Ballroom A/B
For your safety and because of fire regulations, only those with seats will be allowed in meeting rooms. To comply with fire codes, we will have to ask any persons sitting on the floor or standing to leave the room.

Please remember:
• All meeting rooms will be cleared between presentations.
• All seats are available on a first-come, first-served basis.
• Reserving spaces in line or saving seats is not permitted.
• As a courtesy to the speaker and your colleagues, please turn off your cell phone during all presentations.
6
Problem Posing in Mathematics Classrooms
Brief Research Report
There is much research on problem solving in mathematics education. There is much less research concerning problem posing. We share findings from three middle-grades classrooms on the kinds of problems students posed and the frequency with which we observed various types of problem posing, and we consider circumstances that support problem posing.

Clayton N. Kitchings
Shorter University, Rome, Georgia
Jessica Pierson Bishop
University of Georgia, Athens

7
Student-Generated Processes for Developing Mathematical Understanding
Brief Research Report
Students’ perspectives can enrich our conceptions of how they understand mathematics. The framework, Student-Generated Processes for Understanding Mathematics, illustrates how students generated and expressed key processes that contributed to their mathematical understanding and empowered them in reforming their identity as mathematical learners.

Janelle McFeeters
University of Alberta, Edmonton, Canada

8
Student Perceptions of Proof as Communication in an Inquiry-Based Course
Brief Research Report
Research on student-centered approaches to teaching proof can identify practices that support meaningful learning of proof. Undergraduates in an inquiry-based introduction to proof course perceived that communicative activities such as discussion, presentation, and critique of peers’ arguments were crucial to developing an understanding of proof.

Jeffrey D. Pair
Middle Tennessee State University, Murfreesboro
Sarah K. Bleiler
Middle Tennessee State University, Murfreesboro

9
Analyzing Coherence of Teacher’s Knowledge Relating Fractions and Ratios
Poster Session
In this study, we use a new analysis tool, Epistemic Network Analysis (Shaffer et al., 2009), to demonstrate and highlight connections among knowledge resources that middle school mathematics teachers evoke while relating fractions and ratios. Patterns emerged in the connections of teachers’ knowledge resources that were used to group the teachers.

Travis Weiland
University of Massachusetts Dartmouth
Gal Gili Nagar
University of Massachusetts Dartmouth
Chandra Hawley Orrill
University of Massachusetts Dartmouth
James P. Burke
University of Massachusetts Dartmouth

10
Diagnosing Student Misconceptions about Representing Fractions
Poster Session
Learn about an effort to design, test, and validate open source, diagnostic assessments targeting critical rational number topics. The poster session will provide insight into the qualitative and quantitative analysis efforts as well as give key considerations when designing short diagnostic items and support materials.

Michelle Cerrone
Education Development Center, New York, New York
Margaret (Peggy) Clements
Education Development Center, New York, New York

11
Exploring Mathematical Activity Outdoors and Indoors: An Embodied Intervention
Poster Session
This paper describes a design research study on number sense development for elementary students in an after-school program. The study weaves together Realistic Mathematics Education (RME) and Embodied Cognition (EC) theories to reconsider the role of the human body in mathematical activity.

William J. Campbell
University of Colorado Boulder
12
Factors Affecting Mathematics Teachers’ Perspective Toward CCSSM
Poster Session
The purpose of this study is to investigate factors affecting mathematics teachers’ understanding and interpretation of the Common Core State Standards for Mathematics and the degree to which these factors are associated. A path analysis will be performed on a survey data and the results will be presented.

Orhan Kaplan
University of Florida, Gainesville

Grand Ballroom C/D

13
Factors That Influence the Solution Strategies That Preservice Teachers Select
Poster Session
This study explores relationships between unpacked learning goals and the ways preservice teachers (PSTs) select strategies for discussions. The results suggest that some strategies prompt PSTs to attend to the learning goals more than others and that unpacked learning goals might not be enough support for PSTs to select strategies productively.

Erin Meikle
University of Delaware, Newark

Grand Ballroom C/D

14
High School Mathematics Teachers’ Responses to Professional Development on Discourse
Poster Session
After participating in a professional development course on discourse, high school mathematics teachers reflect on their own practice using the new techniques. This session will share findings from a qualitative study, reporting on these teachers’ responses to their own efforts to incorporate powerful and productive discussions in their classes.

Cara M. Goldberg
Lexington Public Schools, Lexington, Massachusetts

Grand Ballroom C/D

15
How Mathematical Knowledge for Teaching Intersects with Teaching Practices
Poster Session
Understanding the relationship of teachers’ mathematical knowledge to their actual practice is an important problem for mathematics education research. In this poster, I present research from a study investigating the mathematical knowledge for teaching (MKT) and reasoning entailed in the practices of selecting examples and giving explanations.

Rachel B. Snider

Grand Ballroom C/D

16
Investigating Norms of the Situation of Geometric Calculation in Algebra
Poster Session
The poster presents a research instrument designed to explore the existence of norms in the instructional situation of geometric calculations in algebra. The instrument was piloted with twenty-nine high school mathematics teachers. The data provides evidence that high school mathematics teachers recognize the hypothesized norms targeted by the instrument.

Nicolas Boileau
University of Michigan, Ann Arbor

Grand Ballroom C/D

17
It’s Not an Issue in My Class: Noticing Student Participation
Poster Session
This qualitative study of a long-term professional development program on Complex Instruction, investigated the increased level of noticing from the teacher participants as they learned about status and its influence on their students’ mathematical participation.

Maggie M. Hackett
Sunnyside Unified School District, Tucson, Arizona

Grand Ballroom C/D

18
Links Between Lab-Based Measures of Numerical Competence and TEMA Scores
Poster Session
Lab-based measures of numerical competence (e.g., number-line estimation) predict performance on formal math assessments. However, developmental psychologists debate the most common explanation of this link. We tested children on number line estimation, visual set comparison, and the Test of Early Mathematics Ability (TEMA) to explore the sources of these links.

Hilary Barth
Wesleyan University, Middletown, Connecticut

Grand Ballroom C/D
19
Mathematical Discourse: Applying Genre Analysis of Narrative to Problem Solving

Poster Session
Language is the principal resource for making meaning through mathematical discourse. However, preservice teachers (PTs) often find the specialized language of mathematics challenging. Using narrative genre analysis, this study reports the ways that language choices of secondary PTs impacted elementary PTs’ sense-making of whole number division.

Janet M. Liston
University of Arizona, Tucson

Grand Ballroom C/D

20
Multilevel Analysis of SIMCE 2011: Factors Related to Fourth-Grade Students’ Achievement

Poster Session
This poster summarizes a study whose purpose was to find a relationship among economics, school factors, and students’ activities that affected the students’ mathematics achievement in fourth-grade Chilean students. A two-level cross-sectional analysis was performed using the SIMCE 2011 data set.

Rayen Antillanca
University of Georgia, Athens

Grand Ballroom C/D

21
Preparing Teacher Candidates to Work with English Language Learners

Poster Session
This presentation concerns initial research with mathematics teacher educators, examining reported beliefs and practices related to preparing preservice teachers to work with ELLs. Initial findings hold implications for teacher educators, K–12 teachers, and education personnel who provide professional development for mathematics teachers.—

Linda A. Arnold
Monmouth University, West Long Branch, New Jersey

Grand Ballroom C/D

22
Project-Based Learning in Secondary Mathematics

Poster Session
To make project-based learning a more accessible teaching method, we did a case study of secondary mathematics students using project-based learning to better understand the best practices involved in its success. Attendees will hear the results of the study and related research.

Sarah C. Zierhoffer
Elon University, Elon, North Carolina
Janet Mays
Elon University, Elon, North Carolina

Grand Ballroom C/D

23
Recruiting STEM Majors into Teaching: Findings from an Elective Course

Poster Session
Findings from the study of a one-hour introductory education elective designed to recruit STEM majors into teaching will be discussed. Primary data sources included reflective journals, pre-questionnaires, and end-of-course surveys. Findings indicated the course did influence STEM student decisions to pursue (or not to pursue) teaching.

Jan Yow
University of South Carolina, Columbia
Rebecca Spencer
Ewing Middle School (Cherokee County School District), Gaffney, South Carolina

Grand Ballroom C/D

24
Statistical Content of Elementary Textbooks

Poster Session
This study examined five mathematics textbooks series for grades 1–5 using a coding protocol based on the GAISE framework to discern the statistical content of each series. We report our findings in terms of the location of statistics tasks within each book and the phases of the statistical problem-solving process that are addressed.

Dustin Jones
Sam Houston State University, Huntsville, Texas
Alisha Dunkle
Hood College, Frederick, Maryland
Lindsay Hixon
Sam Houston State University, Huntsville, Texas
Nicole Yoder
Eastern Mennonite University, Harrisonburg, Virginia

Grand Ballroom C/D
25
Task Design to Support English Learners’ Geometric Record Keeping

Poster Session
We hypothesize that record keeping supports mathematical problem solving and communication of English learners (ELs) through cognitive off-loading of information and supports for productive struggle. Through iterative task design, interviews, and analysis, we generated and tested principles for designing tasks to promote ELs’ record keeping.

Jill Neumayer DePiper
Education Development Center, Waltham, Massachusetts
Daniel Heck
Horizon Research, Inc., Chapel Hill, North Carolina
Anthony Fernandes
University of North Carolina at Charlotte

Grand Ballroom C/D

26
Teachers’ Understanding of Ratios and Their Connections to Fractions

Poster Session
The study examined teachers’ understanding of the relationship between fractions and ratios. We found that participants hold multiple definitions for ratios; they used specific vocabulary; and they expressed additive strategies rather than multiplicative relationships. These findings have implications for professional development.

Gal Gili Nagar
University of Massachusetts Dartmouth
Travis Weiland
University of Massachusetts Dartmouth
James P. Burke
University of Massachusetts Dartmouth
Chandra Hawley Orrill
University of Massachusetts Dartmouth

Grand Ballroom C/D

27
Teaching Algebra to Students with Mathematical Learning Disabilities

Poster Session
This session addresses the current state of algebra I instruction for students with Mathematical Learning Disabilities (MLD), as identified through a descriptive mixed methods study. Findings of the study will be shared and examined to identify implications for preservice mathematics education courses.

Sararose D. Lynch
Westminster College, New Wilmington, Pennsylvania

Grand Ballroom C/D

28
Teaching and Learning of Algebra through Models and Modeling Cycle

Poster Session
This study examines in what ways the materials developed for a new mathematics course using a modeling approach support high-school students to succeed in a first-year algebra course taken concurrently. The research also looks at how teachers use components of the instructional materials, including technology, in their planning and teaching.

Judith Olson
University of Hawaii, Honolulu
Melfried Olson
University of Hawaii, Honolulu
Fay Zenigami
University of Hawaii, Honolulu
Linda Venenciano
University of Hawaii, Honolulu

Grand Ballroom C/D

29
Testing and “Bubble Students”: High School Teachers’ Assessment Practices

Poster Session
We describe how the assessment practices of mathematics teachers at an urban high school were influenced by their state’s standardized test. We found the language used on “the test” to classify students by their performance (e.g., Unsatisfactory) was utilized to label students and was used in both assessment design and assigning student grades.

Richard S. Kitchen
University of Denver, Denver, Colorado
Joe B. Bolz
University of Denver, Denver, Colorado

Grand Ballroom C/D

29.1
Design-Based Implementation Research as a Strategy for Expanding Opportunity to Learn in School Districts

Opening Session
Design-Based Implementation Research (DBIR) is an approach to research and development that can support district-level efforts to improve teaching and expand opportunities for all students to learn. DBIR is organized around problems of practice, and researchers collaborate with teachers and district leaders to design and test innovations. In this presentation, we will describe the principles of DBIR, and how we are applying them in Denver Public Schools’ efforts to expand all students’ access to rigorous mathematics tasks and build teacher leadership in the district.

William R. Penuel
University of Colorado Boulder
Catherine Martin
Denver Public Schools

Grand Ballrooms A&B (Combined)
8:30 a.m.–9:45 a.m.

30

Conceptualizing and Designing Responsive Teacher Education Using Activity Theory

Discussion Session
This session will focus on using activity theory to decompose teaching practice and understand school settings that mediate the work. Using examples from two secondary teacher education programs, participants will discuss affordances and drawbacks to this approach and potential contributions to research and design of responsive teacher education.

Matthew P. Campbell  
West Virginia University, Morgantown  
Commonwealth Ballroom B

31

Early Mathematics with Mobile Technology: A Research-Practice Collaboration

Discussion Session
Learn about an effort to build a collaboration among mathematics education researchers and K–2 educators to bring more research into the classroom and to improve research relevance for practitioners. Efforts to understand how iPads can be harnessed to spur improved mathematics learning and teaching in early grades will also be discussed.

Josephine Louie  
Education Development Center, Waltham, Massachusetts

Pam Buffington  
Education Development Center, Waltham, Massachusetts

Catherine McCulloch  
Education Development Center, Waltham, Massachusetts

Discussant: Jere Confrey  
College of Education, North Carolina State University, Raleigh

Discussant: Michael Muir  
Auburn School District, Auburn, Maine

Grand Ballroom B

32

Examining Relations Between Mathematics Instructional Practices and Autonomy Support Strategies

Discussion Session
The work focuses on decomposing practice into both mathematics instructional practices and autonomy-supportive strategies in an effort to understand the relations between the two. By analyzing instruction along the two dimensions, insight into integration of the practices to productively support students can be gained.

Calli Shekell  
University of Pittsburgh, Pittsburgh, Pennsylvania

33

Exploring the Role of the Mathematical Horizon for Secondary Teachers

Research Symposium
Studies exploring the role and impact on teaching of secondary teachers’ knowledge of the mathematical horizon will be presented; topics include CCSSM, abstract algebra, real analysis, and statistics. Illustrations connected to classroom teaching practices will be examined and implications for mathematics teacher education discussed.

Nicholas H. Wasserman  
Teachers College, Columbia University, New York, New York

Julianna Stockton  
Sacred Heart University, Fairfield, Connecticut

Keith Weber  
Rutgers University, New Brunswick, New Jersey

Joe Champion  
Boise State University, Boise, Idaho

Brandie Waid  
Teachers College, Columbia University, New York, New York

Andrew Sanfratello  
Teachers College, Columbia University, New York, New York

Discussant: William McCallum  
University of Arizona, Tucson

Otis

33.1

Meeting Place Session #1
The Meeting Place session brings together facilitators and topics nominated by the mathematics education community. Please see the NCTM conference app for updated information on the facilitators and topics of discussion for this session.
Public Perceptions of the (Not) New Mathematics
For decades, attempts to communicate the advantages of reform-based curricula to parents have largely failed. Using phenomenography, we investigate public perceptions of the (not) new mathematics as expressed in responses to recent media coverage as a first phase in a project aimed at learning how to communicate reforms to parents.

Janelle McFeeters
University of Alberta, Edmonton, Canada

Has Reform Shaped Teacher Views on Solving Word Problems without Equations?
We explore how mathematics education reform has influenced what it means to solve word problems in algebra class by analyzing teachers’ perceptions on students’ solutions that use graphs, tables of values, or numeric considerations instead of equations. The structure of our online media-rich questionnaire and pilot findings will be discussed.

Orly Buchbinder
University of Maryland, College Park
Daniel Chazan
University of Maryland, College Park

Mapping the LANDSCAPE of Districts’ Stances on Early Algebra I
This paper reports findings from a national study of U.S. districts’ stances—the policies, practices, and rationales—for algebra I enrollment. While many districts offer algebra to select students prior to high school, they proceed cautiously, and few districts are proactively attempting to improve students’ readiness for taking algebra “early.”

Lindsay M. Keazer
Michigan State University, East Lansing
Joshua Taton
University of Pennsylvania, Philadelphia

Mathematics Methods Classrooms as Sites for Courageous Conversations about Equity
Discussion Session
During this workshop, we will share sample cases prepared for a forthcoming book authored by the presenters. Each case aims to engage prospective mathematics teachers in discussions about privilege and oppression in society and in schools, and in strategies for building inclusive/equitable mathematics classrooms.

Dorothy Y. White
University of Georgia, Athens
Sandra Crespo
Michigan State University, East Lansing
Kristen Bieda

Professional Development on Mathematics Discourse: Investigating Contexts of Enactment
Research Symposium
We examine different enactments of a particular professional development program focused on mathematics classroom discourse in order to better understand its impact on teachers. We explore how aspects of context relate to the findings of our studies.

Beth Herbel-Eisenmann
Michigan State University, East Lansing
Michelle Cirillo
University of Delaware, Newark
Mike Steele
University of Wisconsin–Milwaukee
Jillian M. Cavanna
Michigan State University, East Lansing, Michigan
Faith A. Muirhead
University of Delaware, Newark
Daniel Heck
Horizon Research, Inc., Chapel Hill, North Carolina

Structuring Professional Development around a Mathematics Observational Rubric
Research Symposium
By using an observational tool designed to capture features of mathematics instruction, this presentation addresses two open questions regarding professional development and the study designed to answer the questions: What is the optimal level of facilitation in teachers’ discussions? How do teachers experience PD when watching their own lessons?

Mary Beisiegel
Oregon State University, Corvallis
Eric Anderson
Harvard Graduate School of Education, Cambridge, Massachusetts
Johanna Barmore
Harvard Graduate School of Education, Cambridge, Massachusetts
Barb Gilbert
Harvard Graduate School of Education, Cambridge, Massachusetts
Rebecca Mitchell
Boston College, Chestnut Hill, Massachusetts
Samantha Rabinowicz
Harvard Graduate School of Education, Cambridge, Massachusetts
The Measurement of Time: Cognition, Instruction, and Curriculum

Research Symposium
This symposium features studies investigating various aspects of the teaching and learning of time. Time has long been a challenging area of measurement, due at least in part to the fact that we can neither see nor touch time. We explore issues related to student cognition, teaching, and curriculum.

Darrell Earnest  
University of Massachusetts Amherst

Lorraine M. Males  
University of Nebraska–Lincoln

Chepina Rumsey  
Kansas State University, Manhattan

Discussant: Richard Lehrer  
Vanderbilt University, Nashville, Tennessee

Grand Ballroom A

Centering Voices of Marginalized Researchers in Mathematics Education

Discussion Session
Mathematics education is embedded in interlocking systems of privilege and oppression. We share preliminary work guided by principles of critical race theory to expose these systems and provide voice to marginalized groups. Participant discussion will be strongly encouraged as we seek feedback on this work. Danny Martin will serve as discussant.

Jessica Alyce Wilson  
University of South Florida, Tampa

Indigo Esmonde  
University of Toronto, Toronto, Canada

Ayanna D. Perry  
Knowles Science Teaching Foundation, Moorestown, New Jersey

Commonwealth Ballroom B

Engaging U.S. Researchers with the International Commission on Mathematical Instruction

Research Symposium
Members of the U.S. National Commission on Mathematics Instruction provide an introduction to the activities of the International Commission on Mathematics Instruction (ICMI), including topic studies, awards, outreach, and the International Congress on Mathematics Education (ICME). This international meeting, convened every four years, brings together researchers from around the world. Presenters will discuss the structure of the congress and encourage U.S. researchers to submit proposals to present work at ICME 13, to be held in Hamburg, Germany, July 24–31, 2016.

Janine Remillard  
University of Pennsylvania, Philadelphia

Sybilla Beckman  
University of Georgia, Athens

Roger E. Howe  
Yale University, New Haven, Connecticut

Gail Burrill  
Michigan State University, East Lansing, Michigan

Otis

Interactive Paper Session

Presider: Jeffrey J. Wanko  
Miami University, Oxford, Ohio

Student Understandings of Mathematical Functions and Key Calculus Concepts
In this interactive paper session, we present data from our study on the relationships between students’ ideas about functions and their understandings of key concepts of introductory differential calculus. We will share selected examples of students’ work to illustrate students’ thinking, and we will discuss the implications of this study’s results on teaching calculus at both the high school and undergraduate levels.

Caroline J. Hagen  
Tufts University, Medford, Massachusetts

Collaborative Modeling in Elementary Mathematics
This paper examines elementary students engaged in a modeling activity, and it identifies three shifts in thinking that helped students develop a viable model. We argue that encouraging students’ collaboration, a teacher can successfully orchestrate a modeling activity that emphasizes the tension between the experienced world and the underlying mathematical idea.

Ying Cao  
Tufts University, Medford, Massachusetts

Michelle Wilkerson-Jerde  
Tufts University, Medford, Massachusetts

Roger Tobin  
Tufts University, Medford, Massachusetts

Alfredo Bautista  
Nanyang Technological University, Singapore

Examining Cycles of Mathematical Modeling: A Case of High School Students
This presentation offers findings from a teaching experiment in which high school “repeaters” engaged a sequence of mathematical modeling tasks. By analyzing and extending existing theories about the cyclical nature of modeling, I provide a fine-grained analysis of how model creation occurs within an interactive classroom setting.

Kara Louise Imm  
Math in the City, New York, New York

Stone
42
Noticing Transfer across Medias for Future Elementary Teachers

Discussion Session
In this session, teacher educators share findings from a multi-university research project focused on future teacher noticing and its transfer across written and animated medias. Participant discussion will focus on practices that begin to support the transfer of noticing from university coursework into the elementary classroom.

Anne Estapa  
Iowa State University, Ames

Julie Amador  
University of Idaho, Coeur d’Alene

Zandra U. de Araujo  
University of Missouri, Columbia

Tracy L. Weston  
Middlebury College, Middlebury, Vermont

Rachael Aming-Attai  
University of Indianapolis, Indianapolis, Indiana

Anne Estapa  
Iowa State University, Ames

Julie Amador  
University of Idaho, Coeur d’Alene

Zandra U. de Araujo  
University of Missouri, Columbia

Tracy L. Weston  
Middlebury College, Middlebury, Vermont

Rachael Aming-Attai  
University of Indianapolis, Indianapolis, Indiana

Commonwealth Ballroom A

43
Preparing Preservice Teachers to Enact Equitable Instruction in Mathematics

Research Symposium
Our symposium shares unique strategies for helping new teachers develop mathematical knowledge and skills needed to meet complex standards for teaching math in ways that are deliberately responsive and attentive to issues of race, power, culture, language, and social class preparing them for ambitious and equitable teaching.

Imani Goffney  
University of Houston, Houston, Texas

Julia Aguirre  
University of Washington Tacoma

Jennifer M. Lewis  
Wayne State University, Detroit, Michigan

Deborah Loewenberg Ball  
University of Michigan, Ann Arbor

Meghan M. Shaughnessy  
University of Michigan, Ann Arbor

Lindsey Mann  
University of Michigan, Ann Arbor

Monica Gonzalez  
University of Houston, Houston, Texas

Mary Q. Foote  
Queens College—CUNY, Flushing, New York

Imani Goffney  
University of Houston, Houston, Texas

Julia Aguirre  
University of Washington Tacoma

Jennifer M. Lewis  
Wayne State University, Detroit, Michigan

Deborah Loewenberg Ball  
University of Michigan, Ann Arbor

Meghan M. Shaughnessy  
University of Michigan, Ann Arbor

Lindsey Mann  
University of Michigan, Ann Arbor

Monica Gonzalez  
University of Houston, Houston, Texas

Mary Q. Foote  
Queens College—CUNY, Flushing, New York

Commonwealth Ballroom A

44
Research Issues in Curriculum Studies: Evidence-Based Insights and Future Directions

Research Symposium
As methodologies have become more advanced and sophisticated, the curriculum-based research literature has grown significantly in the past decade. The purpose of this symposium is to synthesize the research on curriculum conducted in the past ten years and to offer an in-depth discussion of methodological issues and future directions.

Jinfa Cai  
University of Delaware, Newark

James E. Tarr  
University of Missouri, Columbia

Discussant: Kathryn B. Chval  
University of Missouri, Columbia

Discussant: Daniel Heck  
Horizon Research, Inc., Chapel Hill, North Carolina

Commonwealth Ballroom C

45
Research on the Digital Revolution in Mathematics Curriculum, Teaching, and Learning

Discussion Session
Digital tools and environments—such as laptops, mobile devices, websites, and software—are viewed as having potentially profound effects on mathematics education. This digital revolution influences the writing of learning materials, the delivery of those materials to students, the role(s) of teachers, interactions among both teachers and learners, and assessment. Following an overview of the state of the art inspired by the proceedings of an international conference held in November 2014, participants will be split into groups to discuss the extant and possible research in each of these aspects of teaching and learning mathematics in a digital age.

Zalman Usiskin  
University of Chicago, Chicago, Illinois

Meg Bates  
University of Chicago, Chicago, Illinois

Zalman Usiskin  
University of Chicago, Chicago, Illinois

Meg Bates  
University of Chicago, Chicago, Illinois

Webster
10:00 a.m.–11:15 a.m.

46
Teacher Learning in Online Environments
Research Symposium
This symposium shares the findings across three constructs regarding the effectiveness of an online M.Ed program for middle grades mathematics and science teachers. The constructs are knowledge and perceptions about equity and social justice, technological pedagogical content knowledge, and teachers’ perceptions of learning in online environments.

Jennifer Chauvot
University of Houston, Houston, Texas
Li Sun
University of Houston, Houston, Texas
Karman Kurban
University of Houston, Houston, Texas

Grand Ballroom A

47
Teachers’ Reasons for Using and Choosing Different Physical Manipulatives
Discussion Session
Understanding why teachers use specific models in the classroom is an important yet under-researched area of mathematics education. The goal of this session is to engage participants in a discussion about a theory of worthwhile models in mathematics classrooms, focused on the use and choice of physical manipulatives.

Eileen Murray
Montclair State University, Montclair, New Jersey
Michelle Stephan
University of North Carolina at Charlotte

Grand Ballroom E

48
Toward a Theory of Productive Use of Student Mathematical Thinking
Research Symposium
Presentations consider (1) the nature of student mathematical thinking (SMT) available to teachers during instruction, (2) teachers’ perceptions of productive use of SMT, and (3) teachers’ abilities to recognize and productively respond to SMT. The work will be discussed in the broader context of developing a theory of productive use of SMT.

Laura R. Van Zoest
Western Michigan University, Kalamazoo
Shari L. Stockero
Michigan Technological University, Houghton
Blake E. Peterson
Brigham Young University, Provo, Utah
Mary A. Ochieng
Western Michigan University, Kalamazoo

Grand Ballroom B

11:30 a.m.–12:00 p.m.

49
A Learning Trajectory for Children’s Understanding of Variable
Brief Research Report
We share results from a design research study by which we identified a trajectory in K–2 children’s understanding of variable and variable notation as they explored functional relationships. Our findings suggest that even young children can begin to think in quite sophisticated ways about these core algebraic concepts.

Maria Blanton
TERC, Cambridge, Massachusetts
Angela Gardiner
TERC, Cambridge, Massachusetts
Katharine B. Sawrey
Tufts University, Medford, Massachusetts

Grand Ballroom E

50
Comparison of Student and Teacher Perceptions of Mathematics Teaching Practices
Brief Research Report
Teachers in a professional development project are becoming skilled in using the NCTM (2014) teaching practices as an instructional framework. In order to evaluate the impact of the project, student and teacher perceptions surveys were developed and administered to assess the implementation of these constructs of mathematics teaching practice.

DeAnn Huinker
University of Wisconsin–Milwaukee
Melissa Hedges
University of Wisconsin–Milwaukee

Faneuil

51
Convincing Arguments? Preservice Teachers’ Initial and Post-Course Views
Brief Research Report
Interviews with five preservice elementary teachers elicited their views of nine mathematical arguments at two points in time, near the beginning of a course emphasizing mathematical argumentation and after its completion. Qualitative analysis reveals substantial changes in the arguments they preferred and their reasons for selecting them.

Michael H. Perkowski
University of Missouri, Columbia

Grand Ballroom B
52
Exploring Equitable Practices: Noticing the Student in the Mathematics
Brief Research Report
While reforms stress equitable practices, teachers lack the support to attend to equity. Our purpose was to better understand equitable practices through exploring teacher noticing. Through interview analysis of three secondary math teachers, we found that although they practice equitable teaching, teachers varied in what they attended to.

Janet Mercado
University of California, Irvine
Elizabeth A. van Es
University of California, Irvine
Victoria M. Hand
University of Colorado Boulder

53
Productive Disciplinary Engagement: Framework for Design
Brief Research Report
This investigation explores the ways in which the four principles of productive disciplinary engagement (Engle and Conant 2002) may be used as a tool for informing the design of the norms, structures, and classroom features that combine to form a learning environment.

Maryellen Williams-Candek
Seneca Valley School District, Wexford, Pennsylvania
Margaret Smith
University of Pittsburgh, Pittsburgh, Pennsylvania

54
Putting Understanding into Practice: Learning to Implement Formative Assessment
Brief Research Report
This paper reports on middle grades teachers’ learning about formative assessment (FA) in FACETS, a two-year professional development program designed to promote an understanding of FA as a comprehensive cycle of instruction and to provide supports for teachers during development of FA classroom practices. Both teacher successes and challenges will be discussed.

Lynn T. Goldsmith
Education Development Center, Inc., Waltham, Massachusetts
Sophia Mansori
Education Development Center, Inc., Waltham, Massachusetts

55
Teachers’ Development of Learning Trajectories: Engaging in Mathematical Practices
Brief Research Report
This session will focus on elementary teachers’ development of rational number learning trajectories. We will share observations of their difficulties with setting goals, sequencing the trajectory, selecting appropriate tasks correlated with instances on the trajectory, and discuss supporting them in demonstrating mathematics teaching practices.

Shelby P. Morge
University of North Carolina Wilmington
Kathleen Lynch-Davis
Appalachian State University, Boone, North Carolina
David Pugalee
University of North Carolina at Charlotte

56
Teachers’ Perspectives on Teaching Mathematics for Social Justice
Brief Research Report
This study investigates the perspectives that secondary math teachers committed to teaching math for social justice bring to their work. Interviews with fifteen teachers from urban cities across the U.S. addressed teachers’ opportunities and challenges developing critical math pedagogies, as well as their visions for improving math education.

Mary Candace Full
University of California, Los Angeles

57
The Development of Children’s Concept Images and Understandings of Fractions
Brief Research Report
This study investigated how children’s concept images and knowledge of 1/2, 1/3, and 1/4 changed as a result of their participation in an instructional intervention based on multiple embodiments of fractions concepts through a mixed methodology.

Xiaofen Zhang
University of Maryland Baltimore County, Baltimore, Maryland
58

Unveiling Preservice Teachers' Multicultural Mathematics Dispositions

Brief Research Report

We present the Multicultural Mathematics Disposition framework as an assessment tool to evaluate the readiness of preservice teachers to teach diverse students. This framework is defined as a function of three dispositional factors: openness, self-awareness/self-reflectiveness, and commitment to culturally relevant mathematics teaching.

Dario Andres Gonzalez
University of Georgia, Athens

Angel Manuel Carreras-Jusino
University of Georgia, Athens

Dorothy Y. White
University of Georgia, Athens

Claudette Tucker
University of Georgia, Athens

Kanita K. DuCloux
Western Kentucky University, Bowling Green

59

Assessing Student Ability and Inclination to Use CCSS MP.7 (Structure)

Discussion Session

As Common Core State Standards for Mathematical Practice (SMP) begin to be implemented, assessment of application of the SMP remains an open question. With a focus on SMP.7, we will discuss an instrument that has been designed and piloted and examines not only student ability to use this SMP but also inclination to do so.

Miriam Gates
Education Development Center, Inc., Waltham, Massachusetts

Al Cuoco
Education Development Center, Inc., Waltham, Massachusetts

Jane M. Kang
Education Development Center, Inc., Waltham, Massachusetts

60

Development of Teachers’ Statistical Reasoning and Confidence in Teaching Statistics

Research Symposium

This symposium will engage participants in considering results and implications from three studies about the development of secondary and post-secondary teachers’ statistical reasoning and confidence for teaching statistics. The studies arise from teachers’ work in a graduate course designed and taught by instructors at two institutions.

Hollylynne Lee
North Carolina State University, Raleigh

Helen M. Doerr
Syracuse University, Syracuse, New York

Bridgette Jacob
SUNY-Onondaga Community College, Syracuse, New York

Tina T. Starling
North Carolina State University, Raleigh

Tyler Pulis
North Carolina State University, Raleigh

Dung Tran
North Carolina State University, Raleigh

Jennifer Nickell
North Carolina State University, Raleigh

Emily Thrasher
North Carolina State University, Raleigh

61

Discussing Design of Measures of Mathematical Knowledge for Teaching

Discussion Session

Researchers from five assessment projects will discuss their methodological and theoretical choices related to assessment design, and how those choices impact their work to improve student access to quality teaching. The assessments considered are all categorized as measures of mathematical knowledge for teaching but differ in principled ways.

Cameron Byerley
Arizona State University, Tempe

Andrew Izsak
University of Georgia, Athens

Patricio G. Herbst
University of Michigan, Ann Arbor

Mark Hoover
University of Michigan, Ann Arbor

Janine Remillard
University of Pennsylvania, Philadelphia

Stacy Musgrave
Arizona State University, Tempe
62
High Impact Strategies for Early Mathematics: A Lesson Observation Tool

Discussion Session
High Impact Strategies for Early Mathematics (HIS-EM) is an observation tool that measures quality of mathematics teaching practice across nine dimensions. Learn how HIS-EM has been used for program evaluation in a large, urban district in preschool through third-grade classrooms.

Jeanine O’Nan Brownell
Erikson Institute, Chicago, Illinois
Erin Reid
Erikson Institute, Chicago, Illinois
Bilge Cerezci
Erikson Institute, Chicago, Illinois

63
Investigations into Mathematics Preservice Teachers’ Practice

Discussion Session
This session takes a focused look at two specific high-leverage practices: eliciting student thinking, and managing student responses. We describe the features of preservice teachers’ enacting these practices and discuss possible implications for teacher education.

Diana Sherman
University of Michigan, Ann Arbor
Annick Rougee
University of Michigan, Ann Arbor

64
Multiplicative Structures across the Curriculum

Research Symposium
We will discuss with the audience results of three third-grade classroom intervention studies on topics from the conceptual field of multiplicative structures (Vergnaud, 2009); namely, division, proportionality, and functions. The results we report call for changes in the mathematics curriculum and practice.

Analucia Schliemann
Tufts University, Medford, Massachusetts
David W. Carraher
TERC, Cambridge, Massachusetts
Alina G. Spinillo
Universidade Federal de Pernambuco, Recife - PE, Brazil
Síntia L. Lautert
Universidade Federal de Pernambuco, Recife - PE, Brazil

65
School-Embedded Professional Development Models to Advance Instructional Practice

Research Symposium
This session investigates two school-embedded professional development models examining critical design features and facilitation structures to foster ongoing teacher learning and improved instruction.

Kristin Lesseig
Washington State University Vancouver
Rebekah Elliott
Oregon State University, Corvallis
Wendy Rose Aaron
Oregon State University, Corvallis

66
The Ethics of Facilitating and Researching Professional Development

Discussion Session
Three mathematics education researchers share their professional development (PD) models and their underlying assumptions of those models. Our goal is to explore the researcher-facilitator relationship to better understand research-practice dilemmas in doing PD. We use the models to highlight ethical issues involved in the work of PD.

Eva Thanheiser
Portland State University, Portland, Oregon
Beth Herbel-Eisenmann
Michigan State University, East Lansing
Mary Beisiegel
Oregon State University, Corvallis

67
Using Data Mining for Real-Time Assessment and Tutoring Inquiry Skills

Research Symposium
Inq-ITS (Inquiry-Intelligent Tutoring System) is a virtual environment for science inquiry skills assessment and learning. In Inq-ITS, middle school students use science microworlds (25+) and inquiry widgets to generate a hypothesis, test it, interpret data, warrant claims, and communicate findings—all key science practices (NRC, 2013). We use educational data-mined algorithms and knowledge-engineered rules to: (1) produce performance assessments of students’ inquiry skills, which are reported to the teacher in real time, and (2) adaptively tutor students in real time via our pedagogical agent, Rex (a cartoon dinosaur). I will report on the system, its design, and current results.

Janice D. Gobert
Worcester Polytechnic Institute, Worcester, Massachusetts
Michael Sao Pedro
Worcester Polytechnic Institute, Worcester, Massachusetts
69  
Examining Student-Centered Instruction in High School Mathematics  
Brief Research Report  
In this study, we explore student-centered approaches to mathematics instruction in high school, examine the relationship between implementation of these approaches and instructional context, and investigate the relationship between student-centered instruction and student (a) engagement and (b) skill in problem solving.

Toni M. Smith  
American Institutes for Research, Washington, D.C.
Kirk Walters  
American Institutes for Research, Washington, D.C.
Steven Leinwand  
American Institutes for Research, Washington, D.C.

Grand Ballroom C

70
Extending the Empirical Basis of a Length Measurement Learning Trajectory  
Brief Research Report  
This report focuses on concepts and strategies exhibited by a large sample of elementary, middle, and secondary students using a hypothetical learning trajectory (LT) for length measurement. Results address a critical outstanding question about how an LT for length measurement extends into the middle and secondary grades.

Cheryl L. Eames  
Southern Illinois University Edwardsville
David B. Klanderman  
Trinity Christian College, Palos Heights, Illinois
Rachel Unverfehrt  
Southern Illinois University Edwardsville

Grand Ballroom A

71
Flowcharts to Assess Professional Noticing: Methods for Coding Open-Ended Responses  
Brief Research Report  
Researchers highlight the development of flowcharts to score video-based assessments of professional noticing capacities to increase coding efficiency and reliability across a large team. The measurement process in this research has potential to refine strategies for assessment of responsive teaching with respect to noticing frameworks and beyond.

Cindy Jong  
University of Kentucky, Lexington, Kentucky
Edna O. Schack  
Morehead State University, Morehead, Kentucky
Jonathan N. Thomas  
Northern Kentucky University, Highland Heights

Commonwealth Ballroom B

72
Focusing on Individuals: An Investigation of Student Engagement  
Brief Research Report  
The MYTEAM project investigated the decline in mathematics engagement and achievement in Australian middle-years students using a series of quantitative and qualitative studies. This presentation tracks one investigative pathway through the five studies that highlights the critical role of individual student differences.

Jennifer A. Way  
University of Sydney, Sydney, Australia

Webster

73
High School Students’ Academic Language Skills in Narrative Solutions  
Brief Research Report  
This study examines high school students’ (n=18) use of academic language in formal written mathematical solutions. We discuss students’ use of linking words, mathematical vocabulary, and syntactic complexity and how these relate to indicators associated with content understanding.

Woong Lim  
Kennesaw State University, Kennesaw, Georgia
Lauren Jeneva Moseley  
Lee University, Cleveland, Tennessee

Commonwealth Ballroom B

74
How Do Teachers Make Sense of Student Work for Instruction?  
Brief Research Report  
In this study, we focus on how grades 3–5 teachers make sense of and interpret artifacts of students' multiplicative thinking, namely the written work that students produce on multiplication and division problems.

Caroline B. Ebby  
University of Pennsylvania, Philadelphia

Stone
Multiple Representations or Algorithms First? The Impact on Student Abilities

Brief Research Report
This study examined the impact of the order of teaching approaches on student abilities. Group 1 (n=22) received multiple representations followed by traditional algorithms. Group 2 (n=21) received these in reverse order. Results indicated ability gains for both groups, but comparisons of effect size found larger growth gains for Group 1.

Mara Alagic
Wichita State University, Wichita, Kansas

76
Responsive Teaching with Fractions

Brief Research Report
We will report on an expert teaching study designed to characterize responsive teaching—instruction that is continually adjusted in response to children's mathematical thinking. We will highlight the teaching moves and decision making involved in responsive teaching when skilled teachers of grades 4–5 engaged with children's fractional thinking.

Victoria Jacobs
University of North Carolina at Greensboro

Susan B. Empson
University of Texas at Austin

Gladys Krause
University of Texas at Austin

D’Anna Pynes
University of Texas at Austin

A Hypothetical Learning Trajectory for Preservice Teachers’ Knowledge of Argumentation

Discussion Session
The goal of this presentation is to share a hypothetical learning trajectory focused on mathematical argumentation. We introduce the notion of a multilayered HLT that incorporates subject matter knowledge and pedagogical content knowledge of mathematical argumentation.

Ian Whitacre
Florida State University, Tallahassee

Chepina Rumsey
Kansas State University, Manhattan

Are the NAEP and PISA Mathematics Assessments Really That Different?

Discussion Session
Results of a study comparing the National Assessment of Education Progress (NAEP) and the Program for International Student Assessment (PISA) will serve as the launching point for participants to explore the similarities and differences of NAEP and PISA assessment frameworks and item pools. Included in the session will be an opportunity to examine and discuss individual item features across the two assessments.

Kim Gattis
American Institutes for Research, Washington, D.C.

Linda Dager Hall
St. Patrick’s Episcopal Day School, Washington, D.C.

Alka Arora
American Institutes for Research, Washington, D.C.
Grand Challenges in Mathematics Education

Research Symposium
Other fields have identified a list of Grand Challenges as a way to prioritize the most pressing problems that research should address. In a recent JRME issue, the NCTM Research Committee wrote a research commentary that argues for initiating this approach for mathematics education. If the field of mathematics education were to identify a list of Grand Challenges, what might the list include? How could we initiate a process to generate that list? What are the associated risks? We invite you to learn about this new NCTM initiative, provide ideas, and engage in a discussion about the future of this endeavor.

Kathryn B. Chval
University of Missouri, Columbia
Cliff Konold
University of Massachusetts Amherst
Michelle Stephan
University of North Carolina at Charlotte
Jeffrey J. Wanko
Miami University, Oxford, Ohio
Marta Civil
University of North Carolina at Chapel Hill
Beth Herbel-Eisenmann
Michigan State University, East Lansing
Trena Wilkerson
Baylor University, Waco, Texas
Michael C. Fish
National Council of Teachers of Mathematics, Reston, Virginia

High School Mathematics Teachers’ Preparedness to Teach the CCSSM Standards

Research Symposium
To teach the CCSSM standards effectively requires that teachers possess rich and coherent mathematical meanings. We will discuss implications of meanings for function, quantity, structure, and rate of change held by 400 high school mathematics teachers in two regions of the U.S for teachers’ preparedness to teach the CCSSM standards.

Patrick W. Thompson
Arizona State University, Tempe
Cameron Byerley
Arizona State University, Tempe
Neil Hatfield
Arizona State University, Tempe
Stacy Musgrave
Arizona State University, Tempe
Hyunkyoung Yoon
Arizona State University, Tempe
Surani Joshua

Investigating Beginning Mathematics Teaching

Research Symposium
This session is focused on a study of beginning mathematics teaching. Presenters will share the definition and rationale for studying beginning mathematics teaching, take up a central pattern we have found in our data, and present the results and challenges of a quantitative substudy.

Lindsey Mann
University of Michigan, Ann Arbor
Deborah Loewenberg Ball
University of Michigan, Ann Arbor
L. Joy Johnson
University of Michigan, Ann Arbor
Susanna Farmer
University of Michigan, Ann Arbor
Delena Harrison
University of Michigan, Ann Arbor
Mark Hoover
University of Michigan, Ann Arbor
Hyman Bass
University of Michigan, Ann Arbor
Discussant: Suzanne Wilson
University of Connecticut, Storrs

Interactive Paper Session
Presider: Amanda Thomas
Penn State Harrisburg

Black Learners’ Persistence with Mathematics: A Qualitative Metasynthesis
In what ways, do black learners, who are successful with mathematics, negotiate their experiences in order to persist with mathematics across time? Using qualitative metasynthesis to interpret patterns across multiple qualitative studies, we found that the answer lies within the ways the learners enacted their sense of agency.

Robert Q. Berry
University of Virginia, Charlottesville
Kateri Thunder
James Madison University, Harrisonburg, Virginia
The Research Divide between Mathematics Education and Special Education

Using a content analysis of a sample of 259 peer-reviewed research reports on PK–12 mathematics published in 2013, this presentation will analyze the current state of mathematics education for those with disabilities, including where research is published, methods used, and underlying theories of pedagogy and dis/ability.

Rachel Lambert
Chapman University, Orange, California

Toward a Socio-Spatial Framework for Urban Mathematics Education Scholarship

The purpose of this presentation is to initiate and forward a new theoretical framing for urban mathematics education scholarship. In the session, we hope to discuss the theoretical elements of the framing and work toward refining it for application in research.

Gregory V. Larnell
University of Illinois at Chicago
Erika C. Bullock
University of Memphis, Memphis, Tennessee

Researchers as Mathematics Teacher Educators: Developing MTE Manuscripts from Research

This session will focus on how researchers can take ideas from their work and craft them into a manuscript suitable for submission to Mathematics Teacher Educator (MTE). Members of the MTE Editorial Board will describe critical aspects of the review process, and co-authors of an MTE article will describe the process they went through.

Sandra Crespo
Michigan State University, Ann Arbor
Kevin C. Moore
University of Georgia, Athens, Georgia
Jason Silverman
Drexel University School of Education, Philadelphia, Pennsylvania
Margaret Smith
University of Pittsburgh, Pittsburgh, Pennsylvania
Laura R. Van Zoest
Western Michigan University, Kalamazoo
Gladis Kersaint
University of South Florida, Tampa

GET PUBLISHED IN MATHEMATICS TEACHER EDUCATOR

The Editorial Panel of Mathematics Teacher Educator is asking for articles that:

✔ Describe teacher learning experiences designed based upon NCTM’s Principles to Actions: Ensuring Mathematical Success for All

✔ Provide evidence of how these experiences have enhanced the knowledge, beliefs, or practices of preservice or in-service teachers.

Principles to Actions coalesces and draws attention to many important ideas that mathematics teacher educators have been implementing in their work for decades.

The Mathematics Teacher Educator is a journal dedicated to building a professional knowledge base for mathematics teacher educators that stems from, develops, and strengthens practitioner knowledge.

Submissions are due before September 1, 2015. For more information visit www.nctm.org/mte.
3:30 p.m.–4:45 p.m.

86
Research on Mathematical Reasoning in Informal Designed Learning Environments

Research Symposium
There are many opportunities to engage both adults and children in mathematics outside of school—in museums, libraries, and even farmers’ markets. Presenters will discuss the possibilities and challenges of supporting mathematical reasoning in informal environments, based on a range of projects in which they have been involved.

Andee Rubin
TERC, Cambridge, Massachusetts

Toni Dancu
Exploratorium, San Francisco, California

Marlene Kliman
TERC, Cambridge, Massachusetts

Jan Mokros
Maine Math and Science Alliance, Augusta, Maine

Ricardo Nemirovsky
San Diego State University, San Diego, California

Lucera Gallegos
Mingei International Museum, San Diego, California

86.1
Meeting Place Session #2
The Meeting Place session brings together facilitators and topics nominated by the mathematics education community. Please see the NCTM conference app for updated information on the facilitators and topics of discussion for this session.

5:00 p.m.–6:00 p.m.

87
An Exploratory Study of “Place Holder Zeroes”

Poster Session
This was an exploratory study focused on investigating a possible gap in students’ conceptual understanding of the relationship between “place holder zeroes” and place value in multi-digit multiplication. Survey data suggested that the term “placeholder zero” may be causing a misunderstanding of actual place value within multi-digit multiplication.

Emily Lauren Brennan
University of Massachusetts Amherst

88
Automaticity and the Learning of Meaningful Mathematics

Poster Session
The session highlights results from a study examining the relationship between middle school students’ automaticity of basic math facts and their standardized test scores. Addressing principles of access, equity, and assessment, researchers will discuss how the presence of an automaticity intervention treatment impacted student’s meaningful math knowledge.

Nancy Blue Williams
University of Georgia, Athens

Cheryll Crowe
Asbury University, Wilmore, Kentucky

Robert Thomas
Eastern Kentucky University, Richmond

Grand Ballroom C/D

89
CCSSM-Aligned Middle Grades Textbooks: How Do They Compare?

Poster Session
In this session, we will share results from an ongoing analysis of CCSSM-aligned middle grades mathematics textbooks with regards to the Geometry and the Ratios and Proportional Relationships domains. These results include similarities and variances in content approach, types of representations used, and what is provided to and required of students in these textbooks.

Shannon Dingman
University of Arkansas, Fayetteville

Dawn Teuscher
Brigham Young University, Provo, Utah

Travis Olson
University of Nevada, Las Vegas

Grand Ballroom C/D

90
Constructing Coordinate Systems: The Case of Morgan and Kaylee

Poster Session
Coordinate systems (CSs) are conventionally used as “representational tools.” However, the conventional use does not take students’ construction of CSs into account nor how students use their CSs in reasoning. Findings from a teaching experiment with two high school students investigating students’ construction of CSs will be presented.

Hwa Young Lee
University of Georgia, Athens

Grand Ballroom C/D
91  
Examining the Impact of Schema-Based Instruction on Problem-Solving Performance  
Poster Session  
This presentation shares findings from a study on the problem-solving performance of second-grade students at risk for mathematical failure. Analysis suggests that schema-based instruction improves problem-solving ability compared to no supplemental instruction. Participants will engage in a discussion concerning implications for classroom practice.

Amy Lingo  
University of Louisville, Louisville, Kentucky

Kristin E. Harbour  
University of Louisville, Louisville, Kentucky

Grand Ballroom C/D

92  
Mathematics Curriculum-Based Assessment and Instruction in Low-Income Preschools  
Poster Session  
Early childhood math consultants partnered with six low-income preschool programs to improve children’s understanding of number and cardinality. A validated curriculum-based measure, which paralleled the game-based curriculum implemented in the classrooms, demonstrated highly significant improvement for children enrolled in the program.

Sally Moomaw  
University of Cincinnati, Cincinnati, Ohio

Grand Ballroom C/D

93  
Outcomes and Enactment of a Mathematics for Teaching Curriculum  
Poster Session  
One discourse-driven curriculum that integrates the CCSSM Standards for Mathematical Practice shows promise in developing preservice teachers’ mathematical knowledge for teaching. Data from instructors highlight differences in the contextual factors, enactment of the curriculum, and valuing of support materials, which could impact preservice teachers’ performance.

Laura Kyser Callis  
Boston University, Boston, Massachusetts

Suzanne H. Chapin  
Boston University, Boston, Massachusetts

Grand Ballroom C/D

94  
Perspectives for Reasoning Quantitatively, Long-Term Effects of a Nonnumeric Approach  
Poster Session  
Research on quantitative reasoning suggests two interpretations of quantification; assigning a number to describe some amount, and conceiving some amount to compare it against others. This study explores the latter, specifically, how students at grades 5 and 12 negotiate quantitative relationships given in equations and length representations.

Linda Venenciano  
University of Hawaii, Honolulu

Fay Zenigami  
University of Hawaii, Honolulu

Melfried Olson  
University of Hawaii, Honolulu

Judith Olson  
University of Hawaii, Honolulu

Grand Ballroom C/D

95  
Preparing Preservice Algebra Teachers to Engage in Mathematics Teaching Practices  
Poster Session  
For this session, we examine data from case studies of three secondary mathematics preparation programs to address a specific question related the Mathematics Teaching Practices of Principles to Actions (NCTM, 2014). In particular, in what ways are these programs preparing future teachers to engage in the practices?

Jeffrey Craig  
Michigan State University, East Lansing

Hyunyi Jung  
Purdue University, West Lafayette, Indiana

Eryn M. Stehr  
Michigan State University, East Lansing

Grand Ballroom C/D
96
Preservice Mathematics Teachers’ Lesson Engagement in a Simulated Virtual Classroom

Poster Session
We present findings from a major component of a problem-solving course, the use of Second Life® to simulate a diverse middle grades math classroom. We conducted an exploratory investigation of student and teacher actions during micro-lessons, through an examination of preservice teachers’ mathematics instruction performance across 21 indicators.

Trina Davis
Texas A&M University, College Station
Gerald Kulm
Texas A&M University, College Station
Salvatore Enrico Paolo Indiogine
Texas A&M University, College Station
Tugba Oner
Texas A&M University, College Station
Glenn Allen Phillips
Texas A&M University, College Station

Grand Ballroom C/D

97
Preservice Teachers’ Perspectives on Language in Latinos’ Math Learning

Poster Session
This study examines preservice teachers’ teaching practices, knowledge, and beliefs specifically in respect to the role of language in teaching mathematics to Latino English language learners. Study findings and implications for teacher education will be discussed.

Cathery Yeh
University of California, Irvine

Grand Ballroom C/D

98
Screencasts as Proxy Audiences for Students’ and their Mathematical Explanations

Poster Session
This session will investigate how screencasts (screen captures of digital devices with audio) served as a proxy audience when elementary students solved multiplication and division story problems. Students took on teacher personas and generated detailed mathematical explanations as they created their screencasts for their potential audience.

Melissa M. Soto
San Diego State University, San Diego, California

Grand Ballroom C/D

99
Special Education Teachers’ Understanding and Instructional Application of Visual Representations

Poster Session
This session will present findings from a survey that examined special education teachers’ understanding of visual representations (VR) for solving mathematics problems, as well as instructional practices for teaching VRs to students with disabilities. Implications for practice will be presented.

Amy Scheuermann
Minnesota State University, Mankato
Mary Murray
Bowling Green State University, Bowling Green, Ohio

Grand Ballroom C/D

100
STEM Interest, Self-Efficacy, and Achievement Among Middle Levels Students

Poster Session
Preliminary results from a three-year longitudinal study of grades 4–8 students’ self-efficacy and interest in STEM, perceptions of mathematics and science instruction, and achievement on state mathematics and science assessments. Findings suggest potential benefits when teachers’ instruction attends to students’ sources of mathematics self-efficacy.

Joe Champion
Boise State University, Boise, Idaho
Kimberly Moore
Texas A&M University–Corpus Christi

Grand Ballroom C/D

101
Supporting Preservice Teachers in Justifying Equivalence of Ratios

Poster Session
In this session, we will share tasks developed to build a foundation for ratio meanings, representations, and language. By examining sample student work, we will discuss how these tasks can work to support preservice teachers’ in justifying the equivalence of ratios and in reasoning proportionally.

Margaret Rathouz
University of Michigan–Dearborn
Rheta Rubenstein
University of Michigan–Dearborn

Grand Ballroom C/D
102
Task Design, Peer Pressure, and Argumentation: The Acceptance of Perceptual Warrants

Poster Session
We explore the development of argumentation in an online, synchronous, dynamic geometry environment. Over time the students provided more and more sophisticated arguments through the prompts, and we explain how the task design supported this, even though certain choices allowed the students to subvert the mathematical possibilities of the task.

Tim Fukawa-Connelly
Drexel University, Philadelphia, Pennsylvania
Jason Silverman
Drexel University, Philadelphia, Pennsylvania

Grand Ballroom C/D

103
Teachers’ Visual Representations of a Simulation Approach to Inference

Poster Session
This poster describes a study of teachers’ visual representations of their understanding of a simulation approach to inference. The teachers had engaged in many simulation tasks in a graduate-level course on teaching and learning statistics.

Jennifer Nickell
North Carolina State University, Raleigh
Hollylynne Lee
North Carolina State University, Raleigh
Helen M Doerr
Syracuse University, Syracuse, New York

Grand Ballroom C/D

104
Using a Teaching Simulation to Assess Mathematical Knowledge for Teaching

Poster Session
This study examined whether it is possible to assess preservice teachers’ mathematical knowledge for teaching (MKT) through their performances on a teaching simulation, focused on eliciting and interpreting a simulated student’s thinking. Findings focus on where MKT could be seen and how it could be measured.

Jillian Peterson Mortimer
University of Michigan, Ann Arbor
Timothy Boerst
University of Michigan, Ann Arbor

Grand Ballroom C/D
105
Codesigning for Equity: Tensions That Arise in Formative Intervention Research

Discussion Session
We describe a project aimed at understanding and decreasing the mathematics opportunity gap in discipline-specific terms, and we highlight three tensions that have arisen related to characteristics of formative intervention research: focusing on a problem of practice, stimulating participants to produce innovations, and expanding participants’ agency.

Al Cuoco
Education Development Center, Inc., Waltham, Massachusetts
Charles Munter
University of Pittsburgh, Pittsburgh, Pennsylvania
Eden Badertscher
Education Development Center, Inc., Waltham, Massachusetts
Melissa Boston
Duquesne University, Pittsburgh, Pennsylvania
Tracy Johns
Pittsburgh Public Schools, Pittsburgh, Pennsylvania
Cynthia Fisher
Pittsburgh Public Schools, Pittsburgh, Pennsylvania
Toni Murdock
Pittsburgh Public Schools, Pittsburgh, Pennsylvania
Rose Mary Schmitt
Southbrook Middle School, Pittsburgh, Pennsylvania
Discussant: Danny B. Martin
University of Illinois at Chicago
Discussant: Na’ilah Suad Nasir
University of California, Berkeley

106
Constructing Arguments: What Students in Grades 2–5 Can Do

Discussion Session
In this discussion session, participants will view video clips of structured interviews with elementary students and consider how different learners productively engage in justifying claims and constructing arguments grounded in representation. We will examine how this work connects to Common Core mathematics practices 3, 6, 7, and 8.

Traci Higgins
TERC, Cambridge, Massachusetts
Susan Jo Russell
TERC, Cambridge, Massachusetts

107
Crafting a Dissertation-Based Research Article for JRME

Research Symposium
Learn how to craft a Journal for Research in Mathematics Education Article (JRME) article from dissertation research. Three authors will describe their experiences publishing in JRME and share tips for writing a journal-length article based on a dissertation study.

Cynthia Langrall
Illinois State University, Normal
JRME Editorial Panel
National Council of Teachers of Mathematics, Reston, Virginia
Katherine E. Lewis
University of Washington, Seattle
David Barnes
National Council of Teachers of Mathematics, Reston, Virginia
Kevin C. Moore
University of Georgia, Athens

108
Functions, Teacher Development, and Student Learning

Research Symposium
We discuss an 18-month graduate-level program for teachers (grades 5–9). The program interweaves mathematics and pedagogy through an emphasis on functions. We examine the program’s impact on teachers’ evolving awareness of students’ reasoning, changes in classroom teaching, and students’ performance on state-administered standardized tests.

David W. Carraher
TERC, Cambridge, Massachusetts
Montserrat Teixidor-i-Bigas
Tufts University, Medford, Massachusetts
Barbara M. Brizuela
Tufts University, Medford, Massachusetts
Analucia Schliemann
Tufts University, Medford, Massachusetts
109
Homework in Our Vision of Excellent Mathematics Programs

Discussion Session
This session will examine the potential role and nature of homework within the vision of mathematics education put forth by Principles to Actions (NCTM, 2014) and identify areas for research to establish best homework practices linked to this vision.

Mara Landers
Los Medanos College, Pittsburg, California

110
Interactive Paper Session

President: Trena Wilkerson
Baylor University, Waco, Texas

Identifying Mathematical Knowledge for Teaching to a Learning Progression
A rational analysis was conducted comparing a student learning progression to a set of mathematical knowledge for teaching (MKT) assessment items, each focused on quadratic functions. The result is an annotated learning progression associating teacher knowledge to specific student learning, demonstrating a potentially useful way to link related research on student learning and teacher knowledge.

Heather Howell
ETS, Princeton, New Jersey

Aurora Graf
ETS, Princeton, New Jersey

Evaluating a Learning Map of Integer Understanding Using Test Responses
We will share the results of a study examining the validity of a learning map related to integers. We analyzed responses from 2,846 middle school students to an assessment containing twenty-five items aligned to sixteen skills in a learning map. Participants will discuss the learning map model and implications for professional development and research.

Angela Broaddus
University of Kansas, Lawrence

Anu Sharma
University of Kansas, Lawrence

Studying the Assumptions Teachers Make within Scenario-Based Assessments
We discuss findings from a study of 107 K–12 mathematics teachers’ responses to scenario-based assessments to examine teachers’ justification of actions. Analysis suggests some items elicit participants to make additional assumptions in order to take a position. We show how we detect those assumptions and how assumptions can be accounted for in terms of the professional obligations of mathematics teaching.

Amanda M. Milewski
University of Michigan, Ann Arbor

Ander Erickson
University of Michigan, Ann Arbor

111
Interactive Paper Session

President: Michelle Stephan
University of North Carolina at Charlotte

Noticing the Other and the Other Noticing: Estimation in a Bilingual Classroom
In this presentation, a bilingual teacher and a mathematics teacher educator will share their experience teaching an estimation unit to a group of fourth-grade bilingual Latino/a students. Although the unit was planned primarily to promote teacher noticing of student ideas (by inspecting student work), soon both teacher and researcher realized the importance of eliciting what students were noticing in the estimation tasks. For example, what appeared to be the students’ failure to grasp the rounding technique turned out to be multiple perspectives (elicited through student interviews) that reflected students’ logical thinking, selectivity, and sense making. Without this “other noticing” and without “noticing the other,” both teacher and students would have ended up feeling frustrated.

Higinio Dominguez
Michigan State University, East Lansing

Melissa Adams
Ridgetop Elementary, Austin, Texas

Standards for Mathematical Practice & Multidimensional Mathematics Teaching
This session uses the teaching practices of a seventh-grade mathematics teacher in a unit on adding and subtracting integers to examine intersections among the NCTM Process Standards, the CCSSM Standards for Mathematical Practice, and characteristics of multidimensional mathematics teaching.

Robert Q. Berry
University of Virginia, Charlottesville

Mark Ellis
California State University, Fullerton

How Partnerships with Teachers Are Core to Linking Research and Practice
Partnerships between researchers and teachers are central to stimulating advancements in my research agenda on supporting students’ meaningful learning, connection making, and technology use in algebra. I will share some reflections on how both researchers and teachers may benefit from classroom-based research that aims to address shared problems of practice.

Nicole L. Fonger
University of Wisconsin–Madison

Otis
112

Teachers’ Perceptions and Uses of Curriculum Materials in CCSSM Contexts

Research Symposium

Four related studies examine survey data, background interviews, and planning interviews to explore teachers’ perceptions and uses of curriculum materials with respect to CCSSM, especially the Standards for Mathematical Practice. The studies further examine instructional supports and the impact of high-stakes assessment and teacher evaluation systems.

Jeffrey Choppin  
University of Rochester, Rochester, New York

Jon D. Davis  
Western Michigan Avenue, Kalamazoo

Zenon Borys  
University of Rochester, Rochester, New York

James Kratky  
Western Michigan University, Kalamazoo

Cynthia Carson  
University of Rochester, Rochester, New York

Discussant: James E. Tarr  
University of Missouri, Columbia

Grand Ballroom D

113

Writing Research for Teachers: Putting Results into Practice

Research Symposium

NCTM is committed to strengthening connections between classroom practice and research in mathematics education. A key way to build this connection is for researchers to publish research results in the three NCTM school journals. Work with this year’s award-winning authors and journal editors to develop your ideas for articles.

Wendy S. Bray  
University of Central Florida, Orlando

Mathematics Teacher Editorial Panel  
National Council of Teachers of Mathematics, Reston, Virginia

Mathematics Teaching in the Middle School Editorial Panel  
National Council of Teachers of Mathematics, Reston, Virginia

Teaching Children Mathematics Editorial Panel  
National Council of Teachers of Mathematics, Reston, Virginia

Grand Ballroom E

113.1

Turning the Common Core into Reality in Every Math Classroom

Plenary Session

With the release of Principles to Action, NCTM has undertaken a major initiative to define and describe specific teaching practices that are essential for high-quality mathematics education for all students. In addition, NCTM has identified strategic priorities to guide its work (i.e., access and equity; advocacy; curriculum, instruction, and assessment; professional development; research; and technology). In this plenary session, the panel will respond to the Principles to Action publication and make recommendations for moving research forward from their diverse perspectives.

Deborah Loewenberg Ball  
University of Michigan, Ann Arbor

Danny B Martin  
University of Illinois, Chicago

Dan Meyer  
Stanford University, San Francisco

Steven Leinwand  
American Institutes for Research, Washington, D.C.

Grand Ballrooms A&B (Combined)

114

An Alternative Mathematics Assessment Mode: Mathematical Modeling

Brief Research Report

This study investigates whether performance on an alternative mode of assessment may provide a means to identify mathematical capabilities that are not captured on conventional measures of mathematics achievement. This alternative mode would identify a broader diversity of talented students who might otherwise be denied access to STEM studies.

Ozgul Kartal  
Illinois Institute of Technology, Chicago

Beyza Aksu  
University of Illinois at Chicago

Stone

Grand Ballroom F
115
Context Matters More for Some Elementary Math Curricula Than Others

Brief Research Report
We examine whether three teacher/classroom characteristics that research has shown influence curriculum implementation also influence curriculum effects. Across the contexts examined, we find one standards-based and one conventional curriculum are equally effective, and either as effective or more effective than the other two curricula studied.

Barbara D Harris
Mathematica Policy Research, Washington, D.C.
Roberto Agodini
Mathematica Policy Research, Princeton, New Jersey

Grand Ballroom D

116
Designing Data Visualizations to Promote Math Learning and Identity Development

Brief Research Report
A researcher and teacher at a diverse urban school partnered to enact a seventh-grade unit where students analyzed and designed visualizations of public city data. We analyze students’ engagement with math content and mathematical agency, and we identify the supports that promoted mathematical depth. The talk will include classroom video and student work.

Michelle Wilkerson-Jerde
Tufts University, Medford, Massachusetts
Elsa Head
Cambridge Public School District, Cambridge, Massachusetts

Commonwealth Ballroom A

117
Development of Integer Addition and Subtraction: The Case of Jace

Brief Research Report
This session will report on a student’s participation in a twelve-week teaching experiment. This session will focus on how Jace solved open numbers sentences with integer addition and subtraction in four different individual interviews. Results provide more robust descriptions of conceptual models for integers and provide a developmental perspective.

Nicole M. Wessman-Enzinger
Illinois State University, Normal

Commonwealth Ballroom C

118
Dimensions of Curricular Noticing

Brief Research Report
This report uses data from four projects to highlight aspects of curricular noticing, which theorizes how teachers make sense of the complexity of curricular materials. We will engage participants in considering how curricular noticing may support mathematics teacher educators in supporting preservice teachers’ engagement with curricular materials.

Julie Amador
University of Idaho, Coeur d’Alene
Darrell Earnest
University of Massachusetts Amherst
Lorraine M. Males
University of Nebraska–Lincoln
Leslie Dietiker
Boston University, Boston, Massachusetts

Webster

119
Examining Students’ Algebraic Thinking through Interview Assessments

Brief Research Report
Our presentation will focus on analyses of children’s responses to early algebra interview assessments completed in grades 3 and 4, further illuminating the impact of our early algebra intervention on children’s algebra readiness as well as highlighting the value of interviewing students to gain insight into their algebraic thinking.

Hannah Kang
University of Wisconsin–Madison
Ana C. Stephens
University of Wisconsin–Madison

Grand Ballroom E

120
Exploring High and Low Instruction Classrooms with High Student Achievement

Brief Research Report
In comparing classrooms with low and high quality instruction where students of color have shown to be successful on state standardized tests, this study asks: what forms of practice seem to be supporting all students’ achievement scores, even in classrooms where the quality of instruction is considered poor?

Mahtab Nazemi
College of Education, University of Washington, Seattle

Grand Ballroom C
121
Life of a MET Grant: Space for Progressive Math Pedagogy

Brief Research Report
Modeling a grant and the ensuing research from inception, the session illustrates the process, from submission of the proposal to NCTM’s Mathematics Education Trust through the life of the research to the final report with results. The session will acquaint participants with a possible funding source and follow the actual research with awardees.

Johnny W. Lott
Chair, Mathematics Education Trust (MET) Board of Trustees; Missoula, Montana

Joel Amidon
University of Mississippi, University, Mississippi

Virginia Cornelius
Lafayette High School, Oxford, Mississippi

Morgan Trevathan
Lafayette High School, Oxford, Mississippi

Commonwealth Ballroom B

122
National Science Foundation Funding Program Overview and Proposal Writing

Research Symposium
NSF Program Officers will summarize funding opportunities available, including the EHR Core Research program and a discussion of the meaning of fundamental research aligned with Stokes’ Pasteur’s Quadrant. A discussion on proposal writing aimed at early-career researchers, particularly those interested in submitting to the CAREER program, will follow.

Finbarr Barry Sloane
National Science Foundation (NSF), Arlington, Virginia

Karen D. King
National Science Foundation (NSF), Arlington, Virginia

Margaret Hjalmarson
George Mason University, Fairfax, Virginia

Grand Ballrooms A&B (Combined)

123
Practice-Based Perspectives of Inquiry Teaching of High School Algebra

Brief Research Report
This study investigated inquiry-based teaching of algebra based on the thinking and practice of exemplary mathematics teachers. Findings based on interviews and classroom observations include three inquiry-oriented perspectives that engage students in unique ways of learning algebra and four aspects of teachers’ thinking that support these perspectives.

Olive Chapman
University of Calgary, Calgary, Canada

Commonwealth Ballroom A

124
Cognitively Demanding Task Implementation and Discourse with English Learners

Discussion Session
Using cognitively demanding tasks has been identified as a key component of equitable teaching practice, although implementing these tasks is challenging. Attendees will view and analyze vignettes highlighting the intersection of cognitively demanding tasks and language development and discuss implications and directions for research and practice.

Zandra U. de Araujo
University of Missouri, Columbia

Sarah Ann Roberts
University of California, Santa Barbara

Craig J. Willey
Indiana University-Purdue University (IUPUI), Indianapolis

William C. Zahner
San Diego State University, San Diego, California

Grand Ballroom E

125
Designing for Change in Teachers’ Practices—Toward Explorative Instruction

Discussion Session
We present initial findings from a study on a professional development program aimed at changing teachers’ instructional practices. We view the trajectory of teachers’ change as moving from engaging students in “ritual” ways, where the goal is satisfying teachers’ authority, towards engaging “exploratively” by mathematizing on their own.

Einat Heyd-Metzuyanim
University of Pittsburgh, Pittsburgh, Pennsylvania

Margaret Smith
University of Pittsburgh, Pittsburgh, Pennsylvania

Victoria L. Bill
Institute For Learning, Pittsburgh, Pennsylvania

Nathan Franz
Syracuse School City District, Syracuse, New York

Lauren Resnick
University of Pittsburgh, Pittsburgh, Pennsylvania

Commonwealth Ballroom A
126
Exploring Different Theoretical Frontiers: Implications for Mathematics Classroom Practice

Research Symposium
In this symposium, panelists discuss how different theoretical traditions available to researchers in the emancipate and/or deconstruct paradigms of inquiry provide new productive ways for researchers, educators, teachers, and policymakers to think and rethink classroom practices, including those outlined in recent policy documents.

David W. Stinson
Georgia State University, Atlanta

Erika C. Bullock
University of Memphis, Memphis, Tennessee

Eric (Rico) Gutstein
University of Illinois at Chicago

Elizabeth de Freitas
Adelphi University, Garden City, New York

Nathalie Sinclair
Simon Fraser University, Burnaby, British Columbia, Canada

Danny B. Martin
University of Illinois at Chicago

Niral Shah
Michigan State University, East Lansing

Indigo Esmonde
University of Toronto, Toronto, Canada

Tesha Sengupta-Irving
University of California, Irvine

Grand Ballrooms A&B (Combined)

127
Interactive Paper Session

Presider: Joel Amidon
University of Mississippi, University, Mississippi

First-Grade Students’ Uses of Tables as They Explore Functional Relations
We present first graders’ uses of function tables as they explored relationships between quantities, drawing from a design study investigating functional thinking. Findings suggest children used tables as organizational tools, and they looked not just at tables, but also through tables at functional relationships. We take this as evidence that children were using tables as tools to think about functions.

Barbara M. Brizuela
Tufts University, Medford, Massachusetts

Maria Blanton
TERC, Cambridge, Massachusetts

Angela Gardiner
TERC, Cambridge, Massachusetts

Katharine B. Sawrey
Tufts University, Medford, Massachusetts

Ashley Newman-Owens
Tufts University, Medford, Massachusetts

Teacher Responses to Students’ Informal Methods of Countable Subtraction
We investigate teacher responses to students’ informal methods of subtraction and provide evidence that relatively few teachers in our sample properly interpret what Fuson (1984) has called the cardinal method and furthermore negatively appraise student work of this nature, requesting instead the use of the measurement method. If students are to be supported in their early learning of mathematics, interventions for teacher professional learning may be suggested in the teacher responses.

Kristi Hanby
University of Michigan, Ann Arbor

Patricio G. Herbst
University of Michigan, Ann Arbor

Promoting Preschool Children’s Math Learning through Technology Integration
Results from two randomized controlled studies are presented to demonstrate developmentally appropriate ways of integrating technology into preschool classrooms to support math learning. Outcomes include gains in children’s math knowledge and teachers’ increased comfort and knowledge of early math content and using technology to support learning.

Phil J. Vahey
SRI International, Menlo Park, California

Deborah Rosenfeld
Education Development Center, Inc., New York, New York

Ashley Lewis-Presser
Education Development Center, Inc., New York, New York
128
Interactive Paper Session
Presider: Sarah K. Bleiler
Middle Tennessee State University, Murfreesboro

Responses to Students’ Math Mistakes and Conjectures: A Study of PSTs
This study explored preservice teachers (PSTs) responses to students’ mathematics mistakes and conjectures.

Xueying Ji
Michigan State University, East Lansing

Examining Teacher Candidates’ Learning and Enactment of Teaching Practices
Using a multiple case study methodology, this research explores secondary mathematics teacher candidates’ learning and enactment of three mathematics teaching practices over the course of a thirteen-month postbaccalaureate teacher preparation program. An extended instructional triangle will serve as the conceptual framework.

Dana Lynn Grosser-Clarkson
University of Maryland, College Park

Pedagogies for Enacting Secondary Instructional and Mathematical Practice
Evidence based teacher education designs need to build teacher candidates’ capacity with skillful instruction. Research on secondary pedagogies of practice examines tools for developing ambitious instruction and participation of candidate and students in authentic mathematics.

Rebekah Elliott
Oregon State University, Corvallis
Wendy Rose Aaron
Oregon State University, Corvallis
Sasiwan Maluangnont
Oregon State University, Corvallis

129
Interactive Paper Session
Presider: Polina Sabinin
Bridgewater State University, Bridgewater, Massachusetts

Using Virtual Manipulatives to Generalize and Justify through Discourse
The purpose of this project was to build theory and knowledge about the nature of students’ mathematical discourse as they work with various virtual manipulative types. Results and videos of students’ discourse will be presented and discussed. The results extend the existing literature on the ways students discuss mathematical ideas while using technology. Instructional implications will also be discussed.

Katie L. Anderson-Pence
University of Colorado Colorado Springs
Patricia S. Moyer-Packenham
Utah State University, Logan

Patterns of Variation and Productive Discourse: An International Comparison
By comparing reform-oriented exemplary lessons developed through lesson study in the U.S. and China, this presentation aims to explore how lessons can maximize student-learning opportunities by appropriately introducing patterns of variation and productive discourse. Using the theory of variation along with funneling and focusing patterns of questioning, we will compare two similar lessons with respect to the Mathematics Teaching Practices.

Kyle Prince
Middle Tennessee State University, Murfreesboro
Angela T. Barlow
Middle Tennessee State University, Murfreesboro

Analyzing Prompts Pressing Students to Write
The math and English language arts Common Core State Standards and related assessments underscore the importance of mathematical writing. We investigated over 1,900 writing prompts found in student editions across nine curriculums. We developed a comprehensive framework to guide an inductive analysis that highlight the features that students are pressed to include in their written responses.

Tutita M. Casa
University of Connecticut, Storrs
Janine M. Firmender
Saint Joseph’s University, Philadelphia, Pennsylvania
Madelyn M. Williams
University of Connecticut, Storrs
Kara La Monica
Woodstock Public Schools, Woodstock, Connecticut
Julie MacSwan
University of Connecticut, Storrs
Learning Lessons from Instruction: A Study of Urban Elementary Classrooms

Research Symposium
We conducted a multiyear, multi-district study to measure and understand effective mathematics teaching in fourth- and fifth-grade classrooms. Using project-developed instruments and video observation, we discuss the nature of instruction, compare instructional features across districts, and examine instruction in statistics and probability lessons.

Heather Hill
Harvard University, Cambridge, Massachusetts

Erica Litke
Harvard University, Cambridge, Massachusetts

Andrea Humez
Boston College, Chestnut Hill, Massachusetts

Claire Gogolen
Harvard University, Cambridge, Massachusetts

Barb Gilbert
Harvard Graduate School of Education, Cambridge, Massachusetts

Katie Lynch
Harvard University, Cambridge, Massachusetts

Discussant: Jal Mehta
Harvard University, Cambridge, Massachusetts

Teachers’ Conceptions, Professional Noticing and Pedagogy of Justification

Research Symposium
We present analyses of three teachers from a two-year project on justification and argumentation in middle school math classrooms. The complementary analyses attend to teachers’ conceptions, professional noticing, and pedagogical practices with respect to justification. We conclude by synthesizing across the analyses and discussing implications.

Megan Staples
University of Connecticut, Storrs

Joanna R. Bartlo
Portland State University, Portland, Oregon

Carolyn McCaffrey James
Portland State University, Portland, Oregon

Jill Newton
Purdue University, West Lafayette, Indiana

Discussant: Kristen Bieda
Michigan State University, East Lansing

Using Discourse Analysis to Uncover Student Development of Mathematical Practices

Discussion Session
Participants will view classroom videos with accompanying transcripts to examine student development of structural reasoning in an algebra class (CCSSM MP.7: “Look for and make use of structure”). A particular discourse-analytic method will be applied for its potential to reveal collective mathematical sense making in the classroom context.

Roser A. Gine
Lesley University, Cambridge, Massachusetts

Commonwealth Ballroom B
134

Contrasting Foci and Methods of K–12 Mathematics Curriculum Evaluation

Brief Research Report

This paper reports on two different goal-oriented curriculum evaluations: one focused on developing course materials to prepare non-STEM students for college mathematics, and the other to measure elementary mathematics teachers' content knowledge through their use of five different sets of fourth- and fifth-grade mathematics curriculum materials.

Steven W. Ziebarth
Western Michigan University, Kalamazoo

Grand Ballroom D

135

Examining Coaches' Role in Schoolwide Instructional Improvement

Brief Research Report

How are strong schoolwide professional communities created? This session proposes an empirically grounded theory of action for mathematics coaching in which coaches design ongoing opportunities for collective learning across a school, creating communities that continually strive to improve math instruction and student learning opportunities.

Lynsey Gibbons
University of Washington, Seattle

Grand Ballroom C

136

Examining High-Impact Practices in Graduate Statistics for the Social Sciences

Brief Research Report

This brief research report describes the results of implementing High-Impact Practices (HIP) into graduate statistics for the social sciences utilizing a quasi-experimental two-group research design for comparing graduate students' average statistics efficacy, leadership skills, and research ethics. NCTM's Principles to Actions and HIP are compared.

Carla J. Thompson
University of West Florida, Pensacola

Giang-Nguyen T. Nguyen
University of West Florida, Pensacola

Commonwealth Ballroom C

137

Function Conceptions of AP Calculus Students

Brief Research Report

In this study, I measured AP Calculus students' understandings of functions at the end of the school year, and I compared their understandings to their performance on the AP Calculus exam.

Adam R. Vrabel
Lourdes University, Sylvania, Ohio

Commonwealth Ballroom B

138

Making Mathematical Practices Explicit in Discourse: Experienced and Beginning Instruction

Brief Research Report

Making mathematical practices explicit while still providing students authentic opportunities to engage in these practices can make instruction more equitable. This study compares how experienced and beginning teachers make mathematical practices explicit in discourse and what this might reveal about the knowledge and skills entailed in doing so.

Sarah Kate Selling
University of Michigan, Ann Arbor

Otis

139

Prospective Teachers' Noticings in Videos of Their Own Mathematics Teaching

Brief Research Report

Video usage has grown in teacher preparation programs, but little is known about what prospective teachers really see and focus on when they watch their own teaching videos. This report will present a study where prospective teachers made video observations after a peer microteaching lab experience, and it will provide opportunities for discussion.

Sarah A. Roller
Michigan State University, East Lansing

Commonwealth Ballroom A

140

Teacher Noticing of Relationships between Earlier and Later Learning

Brief Research Report

This study examines what teachers notice about the relationship between their students' earlier and later learning. Interviews with teachers revealed that teachers often notice when students make connections between earlier and later learning, but they do not often notice when students' later learning about a new topic influences their earlier learning.

Charles Hohensee
University of Delaware, Newark

Stone
141
Teachers Beliefs as Portrayed in NCTM’s Principles to Actions

Brief Research Report
In this session we will discuss results of a research study designed to investigate the extent to which elementary teachers support the beliefs expressed in NCTM’s Principles to Actions and to understand how teachers interpret the statements made by NCTM.

Rick A. Hudson
University of Southern Indiana, Evansville
Lauren J. Rapacki
Indiana University Bloomington
Mi Yeon Lee
Arizona State University, Phoenix

142
The Development of Preservice Teachers’ Visions of Mathematics Instruction

Brief Research Report
The purpose of this study was to examine how preservice elementary teachers’ visions of mathematics instruction developed during their teacher preparation program. Nineteen participants were interviewed multiple times. We will share a trajectory of how visions of mathematics instruction developed, and we will discuss implications for teacher educators.

Temple A. Walkowiak
North Carolina State University, Raleigh
Carrie W. Lee
North Carolina State University, Raleigh
Ashley Whitehead
North Carolina State University, Raleigh

143
Variation in Children’s Understandings of Fractions: Preliminary Findings

Brief Research Report
This research targets children’s informal strategies and knowledge of fractions through their creation and interpretation of multiple representations when solving fractions tasks. Analyses of clinical interviews with grades 2–6 children suggest variation across models of the whole and conflicts between informal and rule-based knowledge.

Nicole L. Fonger
University of Wisconsin—Madison
Dung Tran
North Carolina State University, Raleigh
Natasha Elliott
North Carolina State University, Raleigh

144
Beyond Numbers: Evaluating Novices’ Orientations to Teaching Mathematics

Brief Research Report
A survey with classroom vignettes was developed and used to evaluate novice teachers’ orientation to teaching mathematics. Fifty-two teachers from traditional and alternative preparation programs at one university were surveyed. Response patterns reveal opportunities for preparing teachers to engage in productive teaching practices in high need schools.

William C. Zahner
San Diego State University, San Diego, California
Suzanne H. Chapin
Boston University, Boston, Massachusetts

145
Case Studies of Computation and Algebraic Reasoning in K–2 Students

Brief Research Report
We present video clips and analyses of three individual interviews with a kindergarten student, a first-grade student, and a second-grade student working through a function task. These three cases highlight how arithmetic and algebra are mutually supporting ventures in the mathematical education of young students.

Katharine B. Sawrey
Tufts University, Medford, Massachusetts

146
Culture as Mediator of Mathematics Achievement for African American Students

Brief Research Report
This research examines the relations between co-regulation and self-regulation strategies, help-seeking behaviors, perceptions of teacher support, and the mathematics achievement of African American middle school students (n=440). Structural equation modeling was used to analyze the data.

Morgan Faison
Emory University, Atlanta, Georgia
Patricia Vela
Emory University, Atlanta, Georgia
147 Interpreting Student Work: What Secondary Teacher Candidates Bring to Preparation

**Brief Research Report**
This presentation examines preservice secondary teachers’ interpretations of student work. Participants reasoned mathematically, pedagogically, and with comparisons to personal solutions. Results showed relationships between the interpretations and mathematics knowledge for teaching (MKT). There are also implications for supporting teachers to implement practices in Principles to Actions.

**Erin Baldinger**  
*Arizona State University, Tempe*

148 Investigating Changes in Middle School Students’ Motivation Levels in Mathematics

**Brief Research Report**
This investigation examined German middle school students’ changes in motivation to learn mathematics. Student motivation levels were assessed relative to specific psychological needs of students based on the motivational theoretical framework of Self-Determination Theory.

**Giang-Nguyen T. Nguyen**  
*University of West Florida, Pensacola*

**Carla J. Thompson**  
*University of West Florida, Pensacola*

149 Middle School Mathematics Teacher Evaluation: Discipline Specific Feedback

**Brief Research Report**
This session focuses on qualitative research study examining middle school mathematics teacher evaluation systems with particular attention to the types of feedback given to teachers by administrators with different levels of mathematics education or experience. Findings and implications are shared.

**Christine P. Trinter**  
*Virginia Commonwealth University, Richmond*

150 Scholarly Practice in Methods: Examining Revisions of a Task

**Brief Research Report**
Improving tasks used in methods courses can encourage better development of high-leverage practices among prospective teachers. We examined the effects of modifications to a video-critique task assigned in a methods course. We will present the improvements in student work found as result of the changes and discuss implications for other tasks.

**Alyson E. Lischka**  
*Middle Tennessee State University, Murfreesboro*

**Wendy B. Sanchez**  
*Kennesaw State University, Kennesaw, Georgia*

151 Towards Inclusive Mathematics Education: A Case Study of Professional Learning

**Brief Research Report**
Students with disabilities continue to lack access to and achievement in rich mathematics. This presentation describes a research project that examined shifts in teacher discourse during a series of professional learning sessions focused on the use of Universal Design for Learning framework in advancing equity in mathematics education.

**Paulo Tan**  
*Indiana University Bloomington*

**Kathleen King Thorius**  
*Indiana University-Purdue University (IUPUI), Indianapolis*
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