

The 21<sup>st</sup> Annual Conference  
of the  
Special Interest Group of the Mathematical Association of  
America  
on  
Research in Undergraduate Mathematics Education

Program  
(without abstracts)



February 22<sup>nd</sup>-24<sup>th</sup>  
2018  
San Diego, CA

## 2018 SIGMAA-RUME CONFERENCE SCHEDULE

Thursday	Friday	Saturday
7:30 AM – 11:30 AM RUME Working Group Meetings	7:00 AM – 8:00 AM Breakfast <i>Point Loma Terrace</i>	7:00 AM – 8:30 AM Breakfast <i>Point Loma Terrace</i>
	8:00-8:30 AM Session 6 – Preliminary Reports	
	8:40-9:10 AM Session 7 – Contributed Reports	8:30-9:00 AM Session 18 – Preliminary Reports
	9:20-9:50 AM Session 8 – Contributed Reports	9:10-9:40 AM Session 19 – Contributed Reports
	9:50-10:20 AM Coffee Break <i>Cabo Courtyard</i>	9:40-10:10 AM Coffee Break <i>Cabo Courtyard</i>
	10:20-10:50 AM Session 9 – Contributed Reports	10:10 – 10:40 AM Session 20 – Preliminary Reports
	11:00-11:30 AM Session 10 – Contributed Reports	10:50-11:20 AM Session 21 – Contributed Reports
1:00 PM – 1:1 PM Opening Session <i>Pt Loma 2&amp;3</i>	11:40 AM-12:10 PM Session 11 – Preliminary Reports	11:30 AM – 12:00 PM Session 22 – Preliminary Reports
1:10-2:10 PM Special Session honoring the work of Ed Dubinsky	12:10 – 1:10 PM (Boxed) Lunch & Business Meeting <i>Pt Loma 2&amp;3</i>	12:00 PM – 1:00 PM (Boxed) Lunch & Mentoring Sessions <i>Pt Loma 2&amp;3; Coronado</i>
2:20-2:50 PM Session 1 – Contributed Reports	1:20 – 1:50 PM Session 12 – Contributed Reports	1:10 PM – 1:40 PM Session 23 – Contributed Reports
3:00-3:30 PM Session 2 – Contributed Reports	2:00-2:30 PM Session 13 – Contributed Reports	1:50-2:20 PM Session 24 – Contributed Reports
3:40-4:10 PM Session 3 – Contributed Reports	2:40-3:10 PM Session 14 – Contributed Reports	2:30-3:00 PM Session 25 – Contributed Reports
4:10 PM – 4:40 PM Coffee Break <i>Cabo Courtyard</i>	3:10-3:40 PM Coffee Break <i>Cabo Courtyard</i>	3:00-4:00 PM Poster Session 2 & Coffee Break <i>Cabo Courtyard</i>
4:40 PM – 5:10 PM ** Session 4 – Contributed Reports	3:40-4:10 PM Session 15 – Preliminary Reports	
5:20-5:50 PM Session 5 – Contributed Reports	4:20-4:50 PM Session 16 – Contributed Reports	4:10-5:40 PM Awards & Plenary Session Pablo Mejia-Ramos <i>Pt Loma 2&amp;3</i>
5:50 PM – 7:00 PM Poster Session 1 & Cash Bar <i>Pt Loma 1</i>	5:00-5:30 PM Session 17 – Contributed Reports	
7:00 PM – 9:30 PM Dinner & Plenary Session Marcy Towns <i>Pt Loma 2&amp;3</i>	5:40-6:40 PM Plenary Session Joanne Lobato <i>Pt Loma 2&amp;3</i>	
	<i>Dinner on your own</i>	<i>Dinner on your own</i>

*Note: Theoretical Reports will be presented in the Contributed Report sessions*

Day

Time

Session Type

**Thursday**

**7:30-11:30**

***Working Group***

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Working Group 1: Equity in Undergraduate Mathematics Education

**Room:** Point Loma 2&3

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Working Group 2: Research on College Mathematics Instructor Professional Growth

**Room:** Point Loma 1

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Working Group 3: Research on Community College Mathematics

**Room:** Private Dining Room

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Working Group 4: Education Research at the Interface of Mathematics and Physics: “Thick” Derivatives

**Room:** Del Mar

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Working Group 5: Statistics Education Research in RUME

**Room:** Bay Room

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Working Group 6: Supporting Faculty to Improve Student Learning and Success in Precalculus Level Courses

**Room:** Coronado

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Working Group 7: Research Opportunities for RUME Researchers in the Context of Mathematics Resource Centers

**Room:** La Jolla

Day	Time	Session Type
<b>Thursday</b>	<b>13:00-13:10</b>	<b><i>Special</i></b>

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Opening Session

**Room:** Point Loma 2&3

Day	Time	Session Type
<b>Thursday</b>	<b>13:10-14:10</b>	<b><i>Special</i></b>

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Honoring the Work of Ed Dubinsky

**Room:** Point Loma 2&3

	Day	Time	Session Type
<b>Session 1</b>	<b>Thursday</b>	<b>14:20-14:50</b>	<b><i>Contributed Report</i></b>

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Development of the Inquiry-Oriented Instructional Measure

*George Kuster, Christopher Newport University; Rachel Rupnow, Virginia Tech; Estrella Johnson, Virginia Tech; Annie Garrison Wilhelm, Southern Methodist University*

**Room:** Point Loma 2&3

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Generating Equations for Proportional Relationships Using Magnitude and Substance Conceptions

*Sybilla Beckmann, University of Georgia; Andrew Izsak, University of Georgia*

**Room:** Private Dining Room

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Our Mathematical Ideas are Part of Our Identity

*Jeffrey Pair, California State University Long Beach; Stanley Lo, University of California San Diego*

**Room:** La Jolla

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Reasoning about Quantities or Conventions: Investigating Shifts in In-service Teachers' Meanings after an On-line Graduate Course

*Teo Paoletti, Montclair State University; Jason Silverman, Drexel University; Kevin Moore, University of Georgia; Madhavi Vishnubhotla, Montclair State University; Zareen Rahman, Montclair State University; Ceire Monahan, Montclair State University;*

**Room:** Del Mar

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Students' Usage of Visual Imagery to Reason about the Divergence, Integral, Direct Comparison, Limit Comparison, Ratio, and Root Convergence Tests

*Steven Jones, Brigham Young University; John Probst, Brigham Young University*

**Room:** Coronado

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The use(s) of 'is' in mathematics

*Paul Dawkins, Northern Illinois University; Matthew Inglis, Loughborough University; Nicholas Wasserman, Teachers College, Columbia University*

**Room:** Point Loma 1

	Day	Time	Session Type
<b>Session 2</b>	<b>Thursday</b>	<b>15:00-15:30</b>	<b>Contributed Report</b>

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Analyzing Narratives About Limits Involving Infinity in Calculus Textbooks

*Miroslav Lovric, McMaster University; Andrijana Burazin, University of Toronto, Mississauga*

**Room:** Coronado

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Cognitive Consistency and Its Relationships to Knowledge of Logical Equivalence and Mathematical Validity

*Kyeong Hah Roh, Arizona State University; Yong Hah Lee, Ewha Womans University*

**Room:** Del Mar

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Computing as a Mathematical Disciplinary Practice

*Elise Lockwood, Oregon State University; Matthew Thomas, Ithaca College; Anna DeJarnette, University of Cincinnati*

**Room:** Point Loma 2&3

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Development of the Elementary Algebra Concept Inventory for the College Context

*Claire Wladis, BMCC/CUNY; Kathleen Offenholley, BMCC/CUNY; Susan Licwinko, BMCC/CUNY; Dale Dawes, BMCC/CUNY; Jae Ki Lee, BMCC/CUNY*

**Room:** La Jolla

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Mind the 's' in Individual-With-Contexts: Two Undergraduate Women Boosting Self-Efficacy in Mathematics

*Fady El Chidiac, University of California, Berkeley; Melissa Carlson, University of California, Berkeley; Sakthi Ponnuswamy, University of California, Berkeley*

**Room:** Private Dining Room

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Using Quantitative Diagrams to Explore Interactions in a Group Work and Problem-Centered Developmental Mathematics Class

*Martha Makowski, University of Alabama; Sarah Lubienski, Indiana University*

**Room:** Point Loma 1

	Day	Time	Session Type
<b>Session 3</b>	<b>Thursday</b>	<b>15:40-16:10</b>	<b><i>Contributed Report</i></b>

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A Study of Calculus Students' Solution Strategies when Solving Related Rates of Change Problems

*Thembinkosi Mkhathshwa, Miami University; Steven Jones, Brigham Young University*

**Room:** Del Mar

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Connecting the Study of Advanced Mathematics to the Teaching of Secondary Mathematics: Implications for Teaching Inverse Trigonometric Functions

*Keith Weber, Rutgers University; Nicholas Wasserman, Teachers College, Columbia University; Juan Pablo Mejia-Ramos, Rutgers University; Tim Fukawa-Connelly, Temple University*

**Room:** Point Loma 2&3

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Early Undergraduates' Emerging Conceptions of Proof and Conviction

*Alison Lynch, California State University, Monterey Bay; Ryan Pugh, California State University, Monterey Bay*

**Room:** La Jolla

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Epistemological Beliefs About Mathematics and Curriculum Goals in the Cognitive Domain: a Case Study of Preservice Secondary Mathematics Teachers

*Tamara Lefcourt Ruby, Efrata College of Education/Bar Ilan University*

**Room:** Private Dining Room

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The Creation of a Humanistic Educational Framework for the Nature of Pure Mathematics

*Jeffrey Pair, California State University Long Beach*

**Room:** Bay Room

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The Potential Virtues of Wicked Problems for Education

*Jeffrey Craig, University of Arizona; Lynette Guzman, University of Arizona; Andrew Krause, Michigan State University*

**Room:** Coronado



Day	Time	Session Type
<b>Thursday</b>	<b>16:10-16:35</b>	<b><i>Break</i></b>

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Coffee Break

**Room:** Cabo Courtyard (Weather Permitting)

	Day	Time	Session Type
<b>Session 4</b>	<b>Thursday</b>	<b>16:40-17:10</b>	<b><i>Contributed Report</i></b>

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A Case of Community, Investment, and Doing in an Active-Learning Business Calculus Course

*Abigail Higgins, California Maritime Academy*

**Room:** Private Dining Room

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Developing Understanding of the Partial Derivative with a Physical Manipulative

*Jason Samuels, CUNY-BMCC; Brian Fisher, Lubbock Christian University*

**Room:** Del Mar

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Didactical Disciplinary Literacy

*Aaron Weinberg, Ithaca College; Ellie Fitts Fulmer, Ithaca College; Emilie Wiesner, Ithaca College; John Barr, Ithaca College*

**Room:** La Jolla

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Framework for Students' Understanding of Mathematical Norms and Normalization

*Kevin Watson, Virginia Tech*

**Room:** Bay Room

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Mathematics Graduate Teaching Assistants' Growth as Teachers: An Unexamined Practice

*Erica Miller, University of Nebraska-Lincoln; Karina Uhing, University of Nebraska - Lincoln; Meggan Hass, University of Nebraska-Lincoln; Rachel Zigterman, University of Nebraska-Lincoln; Kelsey Quigley, University of Nebraska-Lincoln; Yvonne Lai,*

**Room:** Point Loma 2&3

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Proof Norms in Introduction to Proof Textbooks

*Joshua Fagan, Texas State University; Kathleen Melhuish, Texas State University*

**Room:** Coronado

	Day	Time	Session Type
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**Session 5**

**Thursday**

**17:20-17:50**

***Contributed Report***

Developing Strategic Competence With Representations for Growth Modeling in Calculus

*Chris Pyley, University of the Virgin Islands; Celil Ekici, Texas A&M University-Corpus Christi*

**Room:** La Jolla

Professor Goals and Student Experiences in an IBL Real Analysis Course: A Case Study

*Michael Oehrtman, Oklahoma State; Paul Dawkins, Northern Illinois University ; Ted Mahavier, Lamar University*

**Room:** Coronado

Replacing Exam with Self-Assessment: Reflection-Centred Learning Environment as a Tool to Promote Deep Learning

*Juuso Nieminen, University of Helsinki; Jokke Häsä, University of Helsinki; Johanna Rämö, University of Helsinki; Laura Tuohilampi, University of Helsinki*

**Room:** Del Mar

Transforming students' definitions of function using a vending machine applet

*Milan Sherman, Drake University; Jennifer Lovett, Middle Tennessee State University; Allison McCulloch, University of North Carolina - Charlotte; Lara Dick, Bucknell University; Cyndi Edgington, North Caroline State University; Stephanie Casey, Eastern*

**Room:** Private Dining Room

When “Negation” Impedes Argumentation: The Case of Dawn

*Morgan Sellers, Arizona State University*

**Room:** Bay Room

Session	Day	Time	Session Type
<b>Poster Session 1</b>	<b>Thursday</b>	<b>17:50-18:50</b>	<b>Poster</b>

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Active vs. Traditional Learning in Calculus I

*Beth Cory, Sam Houston State University; Taylor Martin, Sam Houston State University*

T22

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Adjunct Instructor Learning Through Implementing Research Based Curriculum

*Zareen Rahman, Montclair State University; Eileen Murray, Montclair State University; Amir Golnabi, Montclair State University*

T6

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An APOS Perspective of Meaning in Mathematics Teaching

*Ahsan Chowdhury, Virginia Tech*

T31

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An Examination of Preservice Mathematics Teachers Using Ratios and Proportions in a Social Justice Context

*Gregory Downing, North Carolina State University; Brittney Black, North Carolina State University*

T4

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Benefits to Students of Team-Based Learning in Large Lecture Calculus

*Travis Peters, Iowa State University; Elgin Johnston, Iowa State University; Heather Bolles, Iowa State University ; Craig Ogilvie, Iowa State University; Alexis Knaub, Western Michigan University; Thomas Holme, Iowa State University*

T11

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Calculus I Instructors' Desires to Improve Their Teaching

*Kevin Watson, Virginia Tech; Sarah Kerrigan, Virginia Tech; Rachel Rupnow, Virginia Tech*

T45

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Capture of Virtual Environments for Analysis of Immersive Experiences

*Camden Bock, University of Maine*

T29

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## Children's Topological Thinking

*Steven Greenstein, Montclair State University; Adam Anderson, Montclair State University*

T24

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## Comparing Students' and Teachers' Descriptions of First Year STEM Instruction

*Kristen Vroom, Portland State University; Sean Larsen, Portland State University*

T33

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## Computational Thinking in Mathematics: Undergraduate Student Perspectives

*Chantal Buteau, Brock University; Ami Mamolo, University of Ontario Institute of Technology; Eric Muller, Brock University; Meghan Monaghan, Brock University*

T18

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## Connecting Physics Students' Conceptual Understanding to Symbolic Forms Using a Conceptual Blending Framework

*Benjamin Schermerhorn, University of Maine; John Thompson, University of Maine*

T23

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## Development of Students' Mathematical Discourse through Individual and Group Work with Nonstandard Problems on Existence and Uniqueness Theorems

*Svitlana Rogovchenko, University of Agder; Yuriy Rogovchenko, University of Agder; Stephanie Treffert-Thomas, Loughborough University*

T25

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## DISA – Digital Self-Assessment for Large University Courses

*Jokke Häsä, University of Helsinki; Johanna Rämö, University of Helsinki; Juuso Nieminen, University of Helsinki*

T35

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## Dynamic Textbooks and their Use in Teaching Linear and Abstract Algebra

*Angeliki Mali, University of Michigan; Vilma Mesa, University of Michigan*

T10

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Essential Aspects of Mathematics as a Practice in Research and Undergraduate Instruction

*Eryn Stehr, Georgia Southern University; Tuyin An, Georgia Southern University*

T13

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Evaluating Perceptions of Proof with Comparative Judgement

*Ben Davies, Loughborough University; Lara Alcock, Loughborough University; Ian Jones, Loughborough University*

T17

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Exploring Neural Correlates for Levels of Cognitive Load During Justifying Tasks

*Shiv Karunakaran, Michigan State University; Abigail Higgins, California State University Maritime Academy; James Whitbread, Jr., Washington State University*

T42

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Faculty Collaboration and its Impact on Instructional Practice in Undergraduate Mathematics

*Nicholas Fortune, North Carolina State University; Karen Keene, NC State University*

T12

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Geometric Reasoning in an Undergraduate on the Autism Spectrum: A Magic Carpet Case

*Jeffrey Truman, Virginia Tech*

T38

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Graduate Teaching Assistants' Evolving Conceptualizations of Active Learning

*Elijah Meyer, Montana State University; Elizabeth Arnold, Montana State University; Jennifer Green, Montana State University*

T44

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Growth Mindset Assessments in Mathematics Classrooms

*Hannah Lewis, Utah State University; Kady Schmeiter, Utah State University*

T30

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Is Mathematics Important for Accounting Learning? – An study on Students' Attitudes and Beliefs

*Ruixue Du, University of Wisconsin Stevens Point; Senfeng Liang, University of Wisconsin Stevens Point; Christine Schalow, University of Wisconsin Stevens Point*

T47

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Learning Assistants in Undergraduate Mathematics Courses: Impacts on Retention Rates

*Natasha Speer, University of Maine; Laura Millay, University of Maine; Erin Vinson, University of Maine*

T20

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Mathematical Reasoning and Proving for Prospective Secondary Teachers

*Orly Buchbinder, UNIVERSITY OF NEW HAMPSHIRE; Sharon McCrone, University of New Hampshire*

T15

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Mathematics Tutors' Perceptions of Their Role

*Christopher McDonald, Oklahoma State University; Melissa Mills, Oklahoma State University*

T41

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MPWR-ing Women in RUME: Continuing Support

*Stacy Musgrave, Cal Poly Pomona; Jessica Ellis, Colorado State University; Kathleen Melhuish, Texas State University; Eva Thanheiser, Portland State University; Megan Wawro, Virginia Tech*

T1

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Multivariable Calculus Textbook Analysis Highlights a Lack of Representation for Non-Cartesian Coordinate Systems

*Chaelee Dalton, Pomona College; Brian Farlow, North Dakota State University; Warren Christensen, North Dakota State University*

T5

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Perceptions of Underrepresented Community College STEM Majors

*Daniel Lopez, Rutgers University*

T14

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Perspectives in the Use of Primary Sources in Undergraduate Mathematics Education: A Triangulation of Author, Instructor, and Student

*Matthew Mauntel, Florida State University; Kathleen M Clark, FSU*

T43

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Pre-Service Teachers' Mathematical Understanding of the Area of a Rectangle

*Betsy McNeal, Ohio State University; sayonita Ghosh Hajra, Hamline University; Ayse Ozturk, Ohio State University; Wyatt Ehlke, Hamline University; Michael Battista, Ohio State University*

T8

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Preservice Secondary Mathematics Teachers' Conceptions of the Nature of Theorems in Geometry

*Tuyin An, Georgia Southern University*

T39

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Queer Students in STEM: The Voices of Amber, Charles, Jenny and Juan

*Matthew Voigt, San Diego State University*

T26

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Red X's and Green Checks: A Preliminary Study of Student Learning from Online Homework

*Allison Dorko, Oklahoma State University*

T27

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Reflections on a Peer-Led Mentorship Program for Graduate Teaching Assistants

*Laura Broley, Concordia University; Sarah Mathieu-Soucy, Concordia University; Ryan Gibara, Concordia University; Nadia Hardy, Concordia University*

T28

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Relationships Between Calculus Students' Ways of Coordinating Units and their Ways of Understanding Integration

*Jeffrey Grabhorn, Portland State University; Steven Boyce, Portland State University; Cameron Byerley, Colorado State University*

T19



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Research on Concept-based Instruction of Calculus

*xuefen gao, ZSTU*

T40

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Seminars to Support Learning Assistants in Mathematics

*Nancy Kress, University of Colorado, Boulder*

T46

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Student reasoning with complex numbers in upper-division physics

*Michael Loverude, California State University Fullert*

T48

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Students' Engagement with a Function Vending Machine Applet

*Patrick Martin, Middle Tennessee State University; Heather Soled, Bucknell University; Jennifer Lovett, Middle Tennessee State University; Lara Dick, Bucknell University*

T7

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Students' Experiences in an Undergraduate Mathematics Class: Case Studies from one Student-Centered Precalculus Course

*Brooke Outlaw, North Carolina State University; Gregory Downing, North Carolina State University*

T3

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Support for Active Learning in Introductory Calculus: Exploring the Relationship between Mathematics Identity and Pedagogical Approaches

*Paran Norton, Clemson University*

T34

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The Development of a Video Coding Instrument for Assessing Instructional Quality in Community College Algebra Classrooms

*Dexter Lim, University of Minnesota*

T37

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The Distribution of the Mathematical Work during One-on-one Tutor Problem Solving

*Linda Burks, Santa Clara University; Carolyn James, University of Portland*

T21

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The STEM Service Courses Initiative of Project PROMESAS: Pathways with Regional Outreach and Mathematics Excellence for Student Achievement in STEM

*Hortensia Soto, University of Northern Colorado; Cynthia Wyles, California State University Channel Islands; Selenne Banuelos, California State University Channel Islands*

T16

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Transitional Conceptions of the Orientation of the Cross Product in CalcPlot3D

*Monica VanDieren, Robert Morris University; Deborah Moore-Russo, University of Oklahoma; Paul Seeburger, Monroe Community College; Jill Wilsey, Niagara County Community College*

T9

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University Teachers' Meanings for Average Rate of Change: Impacts on Student Feedback

*Ian Thackray, University of Maine*

T32

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Using Comparative Judgment to Analyze Precalculus Algebra Exam Tasks

*Kaitlyn Serbin, Virginia Polytechnic Institute and State University*

T36

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What are the Functions of Proof in Introduction to Proof Textbooks

*Elizabeth Haver, Texas State University; Kathleen Melhuish, Texas State University*

T2

Day	Time	Session Type
<b>Thursday</b>	<b>19:00-20:00</b>	<b><i>Meal</i></b>

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Dinner

**Room:** Point Loma 2&3

Day	Time	Session Type
<b>Thursday</b>	<b>20:00-21:00</b>	<b><i>Plenary</i></b>

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Blending Chemical and Mathematical Knowledge: Explorations in Solving Rate Problems in Chemistry

*Marcy Towns*

**Room:** Point Loma 2&3

Day	Time	Session Type
<b>Friday</b>	<b>7:00-8:00</b>	<b><i>Meal</i></b>

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Breakfast

**Room:** Pt. Loma Terrace

	Day	Time	Session Type
<b>Session 6</b>	<b>Friday</b>	<b>8:00-8:30</b>	<b><i>Preliminary Report</i></b>

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A Framework for Analyzing Written Curriculum from a Shape-Thinking and (Co)variational Reasoning Perspective

*Halil Tasova, University of Georgia; Irma Stevens, University of Georgia; Kevin Moore, University of Georgia*

**Room:** Point Loma 2&3

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Building Lasting Relationships: Inquiry-Oriented Instructional Measure Practices

*Rachel Rupnow, Virginia Tech; Tiffany LaCroix, Virginia Tech; Brooke Mullins, Virginia Tech*

**Room:** Point Loma 1

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Exploring the Pedagogical Empathy of Mathematics Graduate Teaching Assistants

*Karina Uhing, University of Nebraska - Lincoln*

**Room:** La Jolla

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How may Fostering Creativity Impact Student Self-efficacy for Proving?

*Paul Regier, University of Oklahoma; Milos Savic, University of Oklahoma*

**Room:** Del Mar

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Investigating Students' Meta-Level Object-Reflections and Discourse-Reflections: The Provocative Power of Primary Historical Sources

*Cihan Can, Florida State University; Janet Barnett, Colorado State University - Pueblo; Kathleen Clark, Florida State University*

**Room:** Bay Room

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Mathematical Competencies and E-Learning: A Case Study of Engineering Students' Use of Digital Resources

*Shaista Kanwal, Universitetet i Agder*

**Room:** Private Dining Room

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Prerequisite Knowledge of Mathematics and Success in Calculus I

*Lori Ogden, West Virginia University; Jennifer Kearns West Virginia University; Nicholas Bowman, West Virginia University*

**Room:** Coronado

	Day	Time	Session Type
<b>Session 7</b>	<b>Friday</b>	<b>8:40-9:10</b>	<b>Theoretical Report</b>

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Drawing on Three Fields of Education Research to Frame the Development of Digital Games for Inquiry-Oriented Linear Algebra

*Michelle Zandieh, Arizona State University; David Plaxco, Clayton State University; Caro Williams-Pierce, University at Albany, SUNY; Ashish Amresh, Arizona State University*

**Room:** Point Loma 2&3

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Finite Mathematics Students' Use of Counting Techniques in Probability Applications

*Kayla Blyman, USMA - Westpoint; Casey Monday, Northern Kentucky University*

**Room:** Del Mar

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Future Middle Grades Teachers' Solution Methods on Proportional Relationship Tasks

*Merve Kursav, Michigan State University; Sheri Johnson, University of Georgia*

**Room:** Private Dining Room

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Generalisation, Assimilation, and Accommodation

*Allison Dorko, Oklahoma State University*

**Room:** La Jolla

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Key Memorable Events During Undergraduate Classroom Learning

*Ofer Marmur, Simon Fraser University*

**Room:** Coronado

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Partitioning a Proof: An Exploratory Study on Undergraduates Comprehension of Proofs

*Eyob Demeke, California State University Los Angeles; David Earls, University of New Hampshire*

**Room:** Point Loma 1

	Day	Time	Session Type
<b>Session 8</b>	<b>Friday</b>	<b>9:20-9:50</b>	<b><i>Contributed Report</i></b>

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An Undergraduate Mathematics Student's Counterexample Generation Process

*Kristen Lew, Texas State University; Dov Žazkis, Arizona State University*

**Room:** Point Loma 1

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Building Models of Students' Use of Sigma Notation

*Kristen Vroom, Portland State University; Sean Larsen, Portland State University; Stephen Strand, CSU Chico*

**Room:** Private Dining Room

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Katlyn's Inverse Dilemma: School Mathematics Versus Quantitative Reasoning

*Teo Paoletti, Montclair State University*

**Room:** La Jolla

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Networking Theories to Design Dynamic Covariation Techtivities for College Algebra Students

*Heather Johnson, University of Colorado Denver; Evan McClintock, University of Colorado Denver; Jeremiah Kalir, University of Colorado Denver; Bary Olson, University of Colorado Denver*

**Room:** Coronado

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Performance and Participation Differences for In-Class and Online Administration of Low-Stakes Research-Based Assessments

*Ben Van Dusen, CSU Chico; Jayson Nissen, CSU Chico; Manher Jariwala, Boston University; Xochith Herrera, CSU Chico; Close Eleanor, Texas State San Marcos*

**Room:** Del Mar

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The next time around: Shifts in argumentation in initial and subsequent implementations of inquiry-oriented instructional materials

*Christine Andrews-Larson, Florida State University; Shelby McCrackin, Florida State University*

**Room:** Point Loma 2&3



Day	Time	Session Type
<b>Friday</b>	<b>9:50-10:15</b>	<b><i>Break</i></b>

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Coffee Break

**Room:** Cabo Courtyard (Weather Permitting)

	Day	Time	Session Type
<b>Session 9</b>	<b>Friday</b>	<b>10:20-10:50</b>	<b>Contributed Report</b>

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An APOS Study on Undergraduates' Understanding of Direct Variation: Mental Constructions and the Influence of Computer Programming

*Cynthia Stenger, University of North Alabama; James Jenkins, University of North Alabama; Jessica Stovall, University of North Alabama; Janet Jenkins, University of North Alabama*

**Room:** Bay Room

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Computational Thinking in University Mathematics Education: A Theoretical Framework

*Chantal Buteau, Brock University; Eric Muller, Brock University; Joyce Mgombelo, Brock University; Ana Isabel Sacristán, Cinvestav-IPN*

**Room:** Del Mar

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Developing Proof Comprehension and Proof by Contradiction Through Logical Outlines

*Darryl Chamberlain Jr., University of Florida; Draga Vidakovic, Georgia State University*

**Room:** Point Loma 1

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Implementation and Impact of a Web-based Activity and Testing System in Community College Algebra

*Shandy Hawk, WestEd; Bryan Matlen, WestEd*

**Room:** Coronado

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The Effect of Self-Efficacy on Student Performance in Calculus

*Asli Mutlu, North Carolina State University; Heather Ba, North Carolina State University; Karen Keene, North Carolina State University*

**Room:** La Jolla

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The Emergence of a Prototype of a Contextualized Algorithm in a Graph Theory Task

*John Griffith Moala, The University of Auckland; Caroline Yoon, The University of Auckland; Igor' Kontorovich, The University of Auckland*

**Room:** Private Dining Room

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Using Machine Learning Algorithms to Categorize Free Responses to Calculus Questions

*Matthew Thomas, Ithaca College; Spencer Bagley, University of Northern Colorado; Mark Urban-Lurain, Michigan State University*

**Room:** Point Loma 2&3

	Day	Time	Session Type
<b>Session 10</b>	<b>Friday</b>	<b>11:00-11:30</b>	<b><i>Contributed Report</i></b>

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Generalizing in Combinatorics Through Categorization

*Zackery Reed, Oregon State University; Elise Lockwood, Oregon State University*

**Room:** La Jolla

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Physics students' construction of differential length vectors for a spiral path

*Benjamin Schermerhorn, University of Maine; John Thompson, University of Maine*

**Room:** Del Mar

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Shape Thinking and the Transfer of Graphical Calculus Images

*M. Katie Burden, University of Central Arkansas; Jason Martin, University of Central Arkansas*

**Room:** Coronado

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Stepping Through the Proof Door: Undergraduates' Experience One Year After an Introduction to Proof Course

*Younggon Bae, Michigan State University; John Smith, Michigan State University; Mariana Levin, Western Michigan University; V. Rani Satyam, Michigan State University; Kevin Voogt, Michigan State University*

**Room:** Point Loma 2&3

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Teaching Linear Algebra: Modeling One Instructor's Decisions to Move between the Worlds of Mathematical Thinking

*Sepideh Stewart, University of Oklahoma; Jonathan Troup, University of Oklahoma; David Plaxco, Clayton State University*

**Room:** Point Loma 1

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Themes in Undergraduate Students' Conceptions of Central Angle and Inscribed Angle

*Biyao Liang, University of Georgia; Carlos Castillo-Garsow, Eastern Washington University*

**Room:** Private Dining Room

	Day	Time	Session Type
<b>Session 11</b>	<b>Friday</b>	<b>11:40-12:10</b>	<b><i>Preliminary Report</i></b>

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Assessing Visual Literacy Competency in Undergraduate Mathematics

*Deniz Kardes Birinci, University of South Florida; Milé Krajcevski, University of South Florida; Gregory McColm, University of South Florida*

**Room:** Bay Room

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First-generation Low-income College Student Perceptions about First Year Calculus

*Gaye DiGregorio, Collaborative for Student Achievement; Jessica Ellis, Colorado State University*

**Room:** Point Loma 2&3

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Productive Failures: From Class Requirement to Fostering a Support Group

*Milos Savic, University of Oklahoma; Devon Gunter, University of Oklahoma; Emily Curtis, University of Oklahoma; Ariana Paz Pirela, University of Oklahoma*

**Room:** Point Loma 1

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Self-Regulation in Calculus I

*Carolyn Johns, The Ohio State University*

**Room:** Del Mar

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Student Understanding of Linear Combinations of Eigenvectors

*Megan Wawro, Virginia Tech; Kevin Watson, Virginia Tech; Michelle Zandieh, Arizona State University*

**Room:** La Jolla

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The Ways Graduate Teaching Assistants Learn to Teach Through Various Professional Development Interactions

*Hayley Milbourne, San Diego State University; Susan Nickerson, San Diego State University*

**Room:** Private Dining Room

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Validating Proofs in Parallel Mathematical and Pedagogical Tasks

*Erin Baldinger, University of Minnesota; Yvonne Lai, University of Nebraska-Lincoln*

**Room:** Coronado

Day	Time	Session Type
<b>Friday</b>	<b>12:10-13:10</b>	<b><i>Meal</i></b>

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Lunch

**Room:** (Boxed Lunch)

Day	Time	Session Type
<b>Friday</b>	<b>12:10-13:10</b>	<b><i>Special</i></b>

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Business Meeting

**Room:** Point Loma 2&3

	Day	Time	Session Type
<b>Session 12</b>	<b>Friday</b>	<b>13:20-13:50</b>	<b><i>Contributed Report</i></b>

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An Initial Exploration of Students' Reasoning about Combinatorial Proof

*Elise Lockwood, Oregon State University; Zackery Reed, Oregon State University*

**Room:** Private Dining Room

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Conceptualizing Students' Struggle with Familiar Concepts in a New Mathematical Domain

*Igor' Kontorovich, The University of Auckland*

**Room:** Del Mar

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Conventions or Constraints? Pre-service and In-service Teachers' Understandings

*Teo Paoletti, Montclair State University; Kevin Moore, University of Georgia; Jason Silverman, Drexel University; David Liss, University of Wisconsin-La Crosse; Stacy Musgrave, Cal Poly Pomona; Madhavi Vishnubhotla, Montclair State University; Zareen*

**Room:** Point Loma 2&3

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How Does Problem Context Shape Students' Mathematical Reasoning on Calculus Accumulation Tasks?

*William Hall, Washington State University*

**Room:** Coronado

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Individual and Situational Factors Related to Lecturing in Abstract Algebra

*Estrella Johnson, Virginia Tech; Rachel Keller, Virginia Tech; Tim Fukawa-Connelly, Temple University; Valerie Peterson, University of Portland*

**Room:** Point Loma 1

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Insights into Students' Images of a Geometric Object and its Formula from a Covariational Reasoning Perspective

*Irma Stevens, University of Georgia*

**Room:** La Jolla

	Day	Time	Session Type
<b>Session 13</b>	<b>Friday</b>	<b>14:00-14:30</b>	<b><i>Contributed Report</i></b>

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A Preservice Mathematics Teacher's Covariational Reasoning as Mediator for Understanding of Global Warming

*Dario Gonzalez, University of Georgia*

**Room:** Del Mar

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An Activity Theory Approach to Mediating the Development of Metacognitive Norms During Problem Solving

*Emilie Hancock, University of Northern Colorado*

**Room:** Point Loma 2&3

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Conceptual Analysis in Cognitive Research: Purpose, Uses, and the Need for Clarity

*Alan O'Bryan, Arizona State University*

**Room:** La Jolla

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Conceptual Blending: The Case of the Sierpinski Triangle Area and Perimeter

*Naneh Apkarian, San Diego State University; Chris Rasmussen, San Diego State University; Michal Tabach, Tel Aviv University; Tommy Dreyfus, Tel Aviv University*

**Room:** Point Loma 1

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Examining the Relationship Between Students' Covariational Reasoning When Constructing and When Interpreting Graphs

*Kristin Frank, Towson University*

**Room:** Coronado

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Gestures as Evidence of Assimilation When Learning Optimization

*Keith Gallagher, West Virginia University; Nicole Infante, West Virginia University*

**Room:** Private Dining Room



	Day	Time	Session Type
<b>Session 14</b>	<b>Friday</b>	<b>14:40-15:10</b>	<b>Contributed Report</b>

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Examining a Mathematician's Goals and Beliefs about Course Handouts

*Sepideh Stewart, University of Oklahoma; Clarissa Thompson, Kent State; Noel Brady, University of Oklahoma*

**Room:** Coronado

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Figurative Thought and a Student's Reasoning About "Amounts" of Change

*Biyao Liang, University of Georgia; Kevin Moore, University of Georgia*

**Room:** Point Loma 1

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Mathematical Knowledge for Teaching Examples in Precalculus: A Collective Case Study

*Erica Miller, University of Nebraska-Lincoln*

**Room:** La Jolla

---

Mathematics cognition reconsidered: on ascribing meaning

*Thorsten Scheiner, The University of Auckland*

**Room:** Private Dining Room

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Revisiting Reducing Abstraction in Abstract Algebra

*Kathleen Melhuish, Texas State University; Annie Bergman, Portland State University; Jennifer Czochoer, Texas State University*

**Room:** Del Mar

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The Generation and Use of Examples in Calculus Classrooms

*Vicki Sealey, West Virginia University; Johnna Bolyard, West Virginia University; Matthew Campbell, West Virginia University; Nicole Engelke Infante, West Virginia University*

**Room:** Point Loma 2&3

Day	Time	Session Type
<b>Friday</b>	<b>15:10-15:35</b>	<b><i>Break</i></b>

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Coffee Break

**Room:** Cabo Courtyard (Weather Permitting)

	Day	Time	Session Type
<b>Session 15</b>	<b>Friday</b>	<b>15:40-16:10</b>	<b><i>Preliminary Report</i></b>

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Assessing Group Learning Opportunities in a First Semester Calculus Course

*Jennifer Kearns, West Virginia University; Johnna Bolyard, West Virginia University*

**Room:** La Jolla

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Engaged Learning through Creativity in Mathematics

*Mika Munakata, Montclair State University; Ashwin Vaidya, Montclair State University; Ceire Monahan, Montclair State University; Erin Krupa, Montclair State University*

**Room:** Del Mar

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Examining Students' Problem Posing Through a Creativity Framework

*Steven Silber, University of Delaware*

**Room:** Private Dining Room

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Leveraging the Perceptual Ambiguity of Proof Scripts to Witness Students' Identities

*Stacy Brown, California State Polytechnic University, Pomona*

**Room:** Point Loma 2&3

---

Modeling the Spread of Ideas in an Inquiry-Oriented Classroom

*Rachel Rupnow, Virginia Tech; Sarah Kerrigan, Virginia Tech*

**Room:** Point Loma 1

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Student's Semantic Understanding of Surjective Functions

*Kelly Bubb, Ohio University*

**Room:** Bay Room

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Testing the Stability of Items in a Survey to Measure Relative Instructional Priorities Among Graduate Teaching Assistants

*Eliza Gallagher, Clemson University; Aubrie Pfirman, Clemson University; Tony Nguyen, Clemson University; Khushikumari Patel, Clemson University*

**Room:** Coronado

	Day	Time	Session Type
<b>Session 16</b>	<b>Friday</b>	<b>16:20-16:50</b>	<b><i>Contributed Report</i></b>

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Developing Preservice Teachers' Mathematical Knowledge for Teaching in Content Courses

*Jeremy Strayer, Middle Tennessee State University; Alyson Lischka, Middle Tennessee State University; Candice Quinn, Middle Tennessee State University; Lucy Watson, Middle Tennessee State University*

**Room:** La Jolla

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Factors Supporting (or Constraining) the Implementation of DNR-based Instruction in Mathematics

*Oswaldo Soto, University of California San Diego; Guershon Harel, University of California San Diego*

**Room:** Coronado

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Peter's Evoked Concept Images for Absolute Value Inequalities in Calculus Contexts

*Erika David, Arizona State University*

**Room:** Point Loma 2&3

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Schema Development in an Introductory Topology Proof

*Ashley Berger, University of Oklahoma; Sepideh Stewart, University of Oklahoma*

**Room:** Private Dining Room

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Student Status in Peer Conferences

*Daniel Reinholz, San Diego State University*

**Room:** Point Loma 1

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Toward a Functional Grammar of Physics Equations

*Kirk Williams, CSU Chico; David Brookes, CSU Chico*

**Room:** Del Mar

	Day	Time	Session Type
<b>Session 17</b>	<b>Friday</b>	<b>17:00-17:30</b>	<b><i>Theoretical Report</i></b>

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Building on Covariation: Making Explicit Four Types of “Multivariation”

*Steven Jones, Brigham Young University*

**Room:** La Jolla

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Challenging the stigma of a small N: Experiences of students of color in Calculus I

*Jessica Hagman, Colorado State University; Vincent Basile, Colorado State University; Daniel Birmingham, Colorado State University; Bailey Fosdick, Colorado State University*

**Room:** Point Loma 1

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Future Middle Grades Teachers’ Coordination of Knowledge Within the Multiplicative Conceptual Field

*Andrew Izsak, University of Georgia; Sybilla Beckmann, University of Georgia*

**Room:** Del Mar

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Observable Manifestations of A Teacher’s Actions to Understand and Act on Student Thinking

*Sinem Bas Ader, Istanbul Aydin University; Marilyn Carlson, Arizona State University*

**Room:** Coronado

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Reasoning About One Population Hypothesis Testing: The Case of Steve

*Annie Childers, University of AR at Little Rock; Draga Vidakovic, Georgia State University; Harrison Stalvey, University of Colorado, Boulder; Aubrey Kemp, Georgia State University; Leslie Meadows, Georgia State University; Darryl Chamberlain Jr.,*

**Room:** Private Dining Room

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Sensemaking in Statewide College Mathematics Curriculum Reform

*Matthew Wilson, Oklahoma State University; Michael Oehrtman, Oklahoma State*

**Room:** Point Loma 2&3

Day	Time	Session Type
<b>Friday</b>	<b>17:40-18:40</b>	<b><i>Plenary</i></b>

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Re-imagining Online Videos for Mathematics Learning

*Joanne Lobato*

**Room:** Point Loma 2&3

Day	Time	Session Type
<b>Saturday</b>	<b>7:00-8:30</b>	<b><i>Meal</i></b>

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Breakfast

**Room:** Pt. Loma Terrace

	Day	Time	Session Type
<b>Session 18</b>	<b>Saturday</b>	<b>8:30-9:00</b>	<b><i>Preliminary Report</i></b>

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Curricular Presentation of Static and Process-Oriented Views of Proof to Pre-service Elementary Teachers

*Taren Going, Michigan State University*

**Room:** Bay Room

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Gauging College Mathematics Instructors' Knowledge of Student Thinking About Limits

*Natasha Speer, University of Maine; Jessica Gehrtz, Colorado State University; Jessica Ellis, Colorado State University*

**Room:** Point Loma 1

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Investigating Student Success in Team-Based Learning Calculus I and in Subsequent Courses

*Heather Bolles, Iowa State University ; Travis Peters, Iowa State University; Elgin Johnston, Iowa State University*

**Room:** Del Mar

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Modus Tollens in Modeling

*Jennifer Czochoer, Texas State University; Jenna Tague, Fresno State University*

**Room:** Private Dining Room

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Surveying Professors' Perceptions of Incorporating History into Calculus I Instruction

*Aaron Trocki, Elon University; Madison Jaudon, Elon University*

**Room:** La Jolla

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The Emergence of a Video Coding Protocol to Assess the Quality of Community College Algebra Instruction

*April Strom, Scottsdale Community College; AI@CC Research Group, AI@CC Research Group*

**Room:** Point Loma 2&3

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The Instructor's Role in Promoting Student Argumentation in an Inquiry-Oriented Classroom

*Chris Rasmussen, San Diego State University; Karen Marrongelle, Portland State University; Oh Nam Kwon, Seoul National University*

**Room:** Coronado



	Day	Time	Session Type
<b>Session 19</b>	<b>Saturday</b>	<b>9:10-9:40</b>	<b><i>Contributed Report</i></b>

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Adapting an Exam Classification Framework Beyond Calculus

*Brian Katz, Augustana College; Sandra Laursen, Ethnography & Evaluation Research*

**Room:** Point Loma 2&3

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Convergent and Divergent Student Experiences in a Problem-Based Developmental Mathematics Class

*Martha Makowski, University of Alabama*

**Room:** La Jolla

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Informal Content and Student Note-Taking in Undergraduate Calculus Classes

*Alex Kopp, Temple University; Tim Fukawa-Connelly, Temple University*

**Room:** Coronado

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Learning Our Way into Effective Professional Development: Networked Improvement Science in Community College Developmental Mathematics

*Haley McNamara, The Carnegie Foundation for the Advancement of Teaching; Ann Edwards, The Carnegie Foundation for the Advancement of Teaching; Carlos Sandoval, University of California Irvine*

**Room:** Del Mar

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The Counter-storytelling of Latinx Men's Co-Constructions of Masculinities and Undergraduate Mathematical Success

*Luis Leyva, Vanderbilt University*

**Room:** Point Loma 1

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Theorizing Silence

*Matthew Petersen, Portland State University*

**Room:** Private Dining Room

Day	Time	Session Type
<b>Saturday</b>	<b>9:40-10:05</b>	<b><i>Break</i></b>

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Coffee Break

**Room:** Cabo Courtyard (Weather Permitting)

	Day	Time	Session Type
<b>Session 20</b>	<b>Saturday</b>	<b>10:10-10:40</b>	<b><i>Preliminary Report</i></b>
A Course in mathematical modeling for pre-service teachers: Designs and challenges			
<i>Joshua Chesler, California State University, Long Beach; Jen-Mei Chang, California State University, Long Beach</i>			
<b>Room:</b> Del Mar			
A Student's Use of Definitions in the Derivation of the Taxicab Circle Equation			
<i>Aubrey Kemp, Georgia State University; Draga Vidakovic, Georgia State University</i>			
<b>Room:</b> Coronado			
Classroom Experiences of Students in a Community College Intermediate Algebra Course			
<i>Anne Cawley, University of Michigan</i>			
<b>Room:</b> Bay Room			
Impacts of Peer Mentorship in a Calculus Workshop on the Mentors' Identities and Academic Experiences in Undergraduate STEM			
<i>Aditya Adiredja, The University of Arizona; Luis Leyva, Vanderbilt University; Jorge Mendoza, The University of Arizona</i>			
<b>Room:</b> Point Loma 2&3			
Integrals, Volumes, and Visualizations			
<i>Krista Bresock, West Virginia University; Vicki Sealey, West Virginia University</i>			
<b>Room:</b> Point Loma 1			
Teachers' Use of Informal Conceptions of Variability to Make Sense of Representativeness of Samples			
<i>Gabriel Tarr, Arizona State University; April Strom, Scottsdale Community College</i>			
<b>Room:</b> Private Dining Room			
Validation of an Assessment for Introductory Linear Algebra Courses			
<i>Muhammad Haidar, Florida State University</i>			
<b>Room:</b> La Jolla			

	Day	Time	Session Type
<b>Session 21</b>	<b>Saturday</b>	<b>10:50-11:20</b>	<b><i>Contributed Report</i></b>

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A Department-Level Protocol for Assessing Students' Developing Competence with Proof Construction and Validation

*Tabitha Mingus, Western Michigan University; Mariana Levin, Western Michigan University*

**Room:** Private Dining Room

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A Model of Task-Based Learning for Research on Instructor Professional Development

*Billy Jackson, State University of New York, Geneseo; Jenq-Jong Tsay, U. Texas Rio Grande Valley; Shandy Hawk, WestEd*

**Room:** Del Mar

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Could Algebra be the Root of Problems in Calculus Courses?

*Sepideh Stewart, University of Oklahoma; Stacy Reeder, University of Oklahoma; Kate Raymond, University of Oklahoma; Jonathan Troup, University of Oklahoma*

**Room:** La Jolla

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E-IBL, Proof Scripts, and Identities: An Exploration of Theoretical Relationships

*Stacy Brown, California State Polytechnic University, Pomona*

**Room:** Point Loma 1

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Exploring the secondary teaching of functions in relation to the learning of abstract algebra

*Nicholas Wasserman, Teachers College, Columbia University*

**Room:** Coronado

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First Results From a Validation Study of TAMI: Toolkit for Assessing Mathematics Instruction

*Charles Hayward, Ethnography & Evaluation Research; Timothy Weston, University of Colorado Boulder; Sandra Laursen, Ethnography & Evaluation Research*

**Room:** Point Loma 2&3

	Day	Time	Session Type
<b>Session 22</b>	<b>Saturday</b>	<b>11:30-12:00</b>	<b><i>Preliminary Report</i></b>

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Cognitive Resources in Student Reasoning about Mean Tendency

*Kelly Findley, Florida State University; Jennifer Kaplan, University of Georgia*

**Room:** Bay Room

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Emerging Instructional Leadership in a New Course Coordination System

*Naneh Apkarian, San Diego State University*

**Room:** Coronado

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Guiding whose reinventions? A gendered analysis of discussions in inquiry-oriented mathematics

*Christine Andrews-Larson, Florida State University; Cihan Can, Florida State University; Alexis Angstadt, Florida State University*

**Room:** Point Loma 1

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Identifying Subtleties in Preservice Secondary Mathematics Teachers' Distinctions Between Functions and Equations

*James Alvarez, The University of Texas at Arlington; Theresa Jorgensen, The University of Texas at Arlington; Kathryn Rhoads, The University of Texas at Arlington*

**Room:** La Jolla

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Measuring Self-Regulated Learning: A Tool for Understanding Disengagement in Calculus I

*Benjamin Sencindiver, Colorado State University; Mary Pilgrim, Colorado State University; James Folkestad, Colorado State University*

**Room:** Point Loma 2&3

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Shape Thinking: Covariational Reasoning in Chemical Kinetics

*Jon-Marc Rodriguez, Purdue University; Marcy Towns, Purdue University; Kinsey Bain, Purdue University*

**Room:** Private Dining Room

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Teacher Learning About Mathematical Reasoning: An Instructional Model

*Robert Sigley, Texas State*

**Room:** Del Mar

Day	Time	Session Type
<b>Saturday</b>	<b>12:00-13:00</b>	<b><i>Meal</i></b>

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Lunch

**Room:** (Boxed Lunch)

Day	Time	Session Type
<b>Saturday</b>	<b>12:00-13:00</b>	<b><i>Special</i></b>

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Mentoring Tables

**Room:** Point Loma 2&3

	Day	Time	Session Type
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<b>Session 23</b>	<b>Saturday</b>	<b>13:10-13:40</b>	<b><i>Contributed Report</i></b>
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Examining the Effectiveness of a Support Model for Introductory Statistics

*Seth Chart, Towson University; Melike Kara, Towson University; Felice Shore, Towson University; Sandy Spitzer, Towson University*

**Room:** Private Dining Room

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Learning Progressions in Mathematics and Physics: An Example for Partial Derivatives

*Paul Emigh, Oregon State University*

**Room:** La Jolla

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Pedagogical Considerations in the Selection of Examples for Definitions in Real Analysis

*Brian Katz, Augustana College; Tim Fukawa-Connelly, Temple University; Keith Weber, Rutgers University; Juan Pablo Mejia-Ramos, Rutgers University*

**Room:** Coronado

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Peer Mentoring Mathematics Graduate Student Instructors: Discussion Topics and Concerns

*Kimberly Rogers, Bowling Green State University; Sean Yee, University of South Carolina*

**Room:** Del Mar

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Scaling-Continuous Variation: A Productive Foundation for Calculus Reasoning

*Robert Ely, University of Idaho; Amy Ellis, University of Georgia*

**Room:** Point Loma 2&3



	Day	Time	Session Type
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**Session 24**                      **Saturday**                      **13:50-14:20**                      ***Contributed Report***

Evaluation of Impact of Calculus Center on Student Achievement

*Cameron Byerley, Colorado State University; Travis Campbell, Colorado State University; Brian Rickard, University of Arkansas*

**Room:** Private Dining Room

Graphing as a Tool for Exploring Students' Affective Experience as Mathematics Learners

*V. Rani Satyam, Michigan State University; Mariana Levin, Western Michigan University; John Smith, Michigan State University; Theresa Grant, Western Michigan University; Kevin Voogt, Michigan State University; Younggon Bae, Michigan State University*

**Room:** Point Loma 1

How Do We Teach Thee? Let Me Count the Ways. A Syllabus Rubric with Practical Promise for Characterizing Mathematics Teaching

*Sandra Laursen, Ethnography & Evaluation Research; Tim Archie, IDEA Center*

**Room:** Point Loma 2&3

Students' Strategies for Setting up Differential Equations in Engineering Contexts

*Omar Naranjo, Brigham Young University; Steven Jones, Brigham Young University*

**Room:** La Jolla

What are Conveyed Meanings from a Teacher to Students?

*Hyunkyung Yoon, Arizona State University*

**Room:** Coronado

	Day	Time	Session Type
<b>Session 25</b>	<b>Saturday</b>	<b>14:30-15:00</b>	<b><i>Contributed Report</i></b>

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Collective Argumentation Regarding Integration of Complex Functions Within Three Worlds of Mathematics

*Brent Hancock, University of Northern Colorado*

**Room:** Private Dining Room

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Generalizations of Convergence from  $\mathbf{R}$  to  $\mathbf{R}^2$

*Zackery Reed, Oregon State University*

**Room:** Point Loma 1

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Planning to Succeed in a Computer-Centered Mathematics Classroom

*Geillan Aly, University of Hartford*

**Room:** Del Mar

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Relationships between Precalculus Students' Engagement and Shape Thinking

*Derek Williams, NC State University*

**Room:** Coronado

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Sparky the Saguaro: A Teaching Experiment Examining a Student's Development of the Concept of Logarithms

*Emily Kuper, ASU; Marilyn Carlson, Arizona State University*

**Room:** La Jolla

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The Authority of Numbers: Fostering Opportunities for Rational Dependence in a Mathematics Classroom

*Ander Erickson, University of Washington Tacoma*

**Room:** Point Loma 2&3

	Day	Time	Session Type
<b>Session</b>	<b>Poster Session 2</b>	<b>Saturday</b>	<b>15:00-16:00</b>
			<b>Poster</b>
<hr/> <b>A Hypothetical Learning Trajectory (HLT) for Preservice Secondary Teachers' Construction of Congruence Proofs</b>			
<i>Rachel Zigterman, University of Nebraska-Lincoln; Yvonne Lai, University of Nebraska-Lincoln</i>			
S35			
<hr/> <b>Adaption of Sherin's Symbolic Forms for the Analysis of Students' Graphical Understanding</b>			
<i>Jon-Marc Rodriguez, Purdue University ; Kinsey Bain, Purdue University; Marcy Towns, Purdue University</i>			
S15			
<hr/> <b>An Instructional Resource for Improving Students' Conceptual Understanding of Functions through "Reflective Abstraction"</b>			
<i>Jessica Lajos, University of Oklahoma; Sepideh Stewart, University of Oklahoma</i>			
S19			
<hr/> <b>Assessing the Development of Students' Mathematical Modeling Competencies: An Information Entropy Approach</b>			
<i>Yannis Liakos, University of Agder; Yuriy Rogovchenko, University of Agder</i>			
S10			
<hr/> <b>Bridge Programs for Engineering Calculus Success</b>			
<i>Sandra Nite, Texas A&amp;M University; Michael Sallean, Texas A&amp;M University</i>			
S34			
<hr/> <b>Characterizing Self Explanations for Undergraduate Proof Comprehension</b>			
<i>Kristen Amman, Rutgers University</i>			
S27			
<hr/> <b>Connecting Advanced Undergraduate Mathematics to School Mathematics</b>			
<i>Elizabeth Arnold, Montana State University; James Alvarez, The University of Texas at Arlington</i>			
S30			

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Constant Rate of Change: The Reasoning of a Former Teacher and Current Doctoral Student

*Natalie Hobson, Sonoma State University*

S17

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Content Analysis of Introductory Textbooks in Point-Set Topology

*Daniel Cheshire, Texas State University; Joshua Fagan, Texas State University*

S32

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Cooperative Learning and its Impact in Developmental Mathematics Courses: A Case Study in a Minority-Serving Institution

*Eyob Demeke, California State University Los Angeles*

S47

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Design Research in German Mathematics Tertiary Education Focusing on Profession-Specificity

*Wessel Lena, University of Education Freiburg*

S16

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Development of reasoning about rate of change, based on quantitative and qualitative analysis

*inyoung lee, Arizona State University*

S45

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Examining Exams, Evaluating Evaluations: An Alternate Approach Assessed

*Kayla Blyman, USMA - West Point Kristin Arney, USMA - West Point David del Cuadro-Zimmerman, USMA - West Point  
Lisa Bromberg, USMA - West Point*

S29

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Exploring Pre-service Elementary Teacher's Relationships with Mathematics via Creative Writing and Survey

*Taekyoung Kim, Oklahoma State University*

S25

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## Exploring Students' Reports of Exclusion in Calculus II

*Jessica Hagman, Colorado State University; Matthew Voigt, San Diego State University; Nancy Kress, University of Colorado, Boulder; Jessica Gehrtz, Colorado State University*

S12

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## Exploring the Efficacy of a Game-Based Learning Application in Undergraduate Mathematics: Functions of the Machine

*Jessica Lajos, University of Oklahoma; Yutian Thompson, University of Oklahoma; Sarah Klankey, University of Oklahoma; Javier Elizondo, University of Oklahoma; Will Thompson, University of Oklahoma; Melanie Lewis,*

S20

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## Exploring the Role of Active Learning in a Large-Scale Precalculus Class

*Gregory Downing, North Carolina State University; Brooke Outlaw, North Carolina State University*

S5

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## Features of Tasks and Instructor Actions That Promote Preservice Secondary Mathematics Teachers' Understanding of Functions

*Janessa Beach, The University of Texas at Arlington; James Alvarez, The University of Texas at Arlington; Theresa Jorgensen, The University of Texas at Arlington; Kathryn Rhoads, The University of Texas at Arlington*

S22

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## Gender-based Analysis of Learning Outcomes in Inquiry-Oriented Linear Algebra

*Brooke Athey, Florida State University*

S28

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## Goals, Resources, and Orientations for Equity in Collegiate Mathematics Education Research

*Shandy Hawk, WestEd; Katie D'Silva, WestEd*

S37

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## Here's What You Do: Personalization and Ritual in College Students' Algebraic Discourse

*Cody Patterson, University of Texas at San Antonio; Luke Farmer, University of Texas at San Antonio*

S14

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Historical analysis on predictive practices: the case of chaotic dynamics

*JESUS ENRIQUE HERNÁNDEZ-ZAVALA, CINVESTAV; Ricardo Cantoral, CINVESTAV*

S13

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How Diagrams are Leveraged in Introduction to Proof Textbooks

*Michael Abili, Texas State University; Elizabeth Hower, Texas State University; Kristen Lew, Texas State University; Kathleen Melhuish, Texas State University; Robert Sigley, Texas State*

S1

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How Experts Conceptualize Differentials: The Results of Two Studies

*Tim McCarty, West Virginia University; Vicki Sealey, West Virginia University*

S7

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If  $f(2)=8$  then  $f'(2)=0$ : A Common Misconception, Part 2

*Alison Mirin, Arizona State University; Stephen Shaffer, Arizona State University*

S46

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Investigating Student Learning and Sense-Making from Instructional Calculus Videos

*Aaron Weinberg, Ithaca College; Matthew Thomas, Ithaca College; Jason Martin, University of Central Arkansas; Michael Tallman, Oklahoma State University*

S18

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Math Help Centers: Factors that Impact Student Perceptions and Attendance

*Christine Tinsley, University of Oklahoma; Beth Rawlins, University of Oklahoma; Deborah Moore-Russo, University of Oklahoma; Milos Savic, University of Oklahoma*

S40

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Mathematics Through the Lens of Service-learning

*sayonita Ghosh Hajra, Hamline University; Jen England, Hamline University; Chloe Mcelmury, Hamline University; Hani Abukar, Hamline University*

S9

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## Quantum Physics Students' Reasoning about Eigenvectors and Eigenvalues

*Kevin Watson, Virginia Tech; Megan Wawro, Virginia Tech; Warren Christensen, North Dakota State University*

S3

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## Student Intuition Behind the Chain Rule and How Function Notation Interferes

*Justin Dunmyre, Frostburg State University; Nicholas Fortune, North Carolina State University*

S8

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## Student Resources for Unit and Position Vectors in Cartesian and Non-Cartesian Coordinate Systems

*Warren Christensen, North Dakota State University; Brian Farlow, North Dakota State University; Marlene Vega, California State University - Fullerton; Michael Loverude, California State University Fullert*

S4

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## Student's Attention to the Conclusion During Proofs

*Sindura Subanemy Kandasamy, Texas State University; Kathleen Melhuish, Texas State University*

S2

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## Students' Understanding of Quadratic Equations

*Jonathan López Torres, North Carolina State University*

S38

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## Supporting Prospective Teachers' Understanding of Triangle Congruence Criteria

*Steven Boyce, Portland State University; Priya Prasad, University of Texas at San Antonio*

S6

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## Teachers' Knowledge of Fraction Arithmetic with Measured Quantities

*Sheri Johnson, University of Georgia; Merve Kursav, Michigan State University*

S44

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Teachers' reasoning with frames of reference in US and Korea

*Surani Joshua, Arizona State University*

S42

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Transformers! More than Meets the Eye!

*Courtney Simmons, Oklahoma State University; Michael Oehrtman, Oklahoma State*

S26

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Using Catan as a Vehicle for Engaging Students in Mathematical Sense-Making

*Miller Susanna Molitoris, Kennesaw State University; Amy Hillen, Kennesaw State University*

S43

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Using Everyday Examples to Understand the Concept of Basis

*Jessica Knapp, Arizona State University; Michelle Zandieh, Arizona State University; Aditya Adiredja, The University of Arizona*

S39

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Video Case Analysis of Students' Mathematical Thinking to Support Preservice Teacher Candidates' Functional Reasoning and Professional Noticing

*Tatia Totorica, Boise State University; Laurie Cavey, Boise State University; Michele Carney, Boise State University; Patrick Lowenthal, Boise State University; Jason Libberton, Idaho State University*

S24

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What Would You Say You Do Here? Metaphor as a Tool to Characterize Mathematical Practice

*Joseph Olsen, Rutgers University*

S21

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What? How? Why? Resources Used to Teach the Fundamental Theorem of Calculus

*Linda Leckrone, University of Michigan*

S31



Day	Time	Session Type
<b>Saturday</b>	<b>16:10-16:40</b>	<b><i>Special</i></b>

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Awards Session

**Room:** Point Loma 2&3

Day	Time	Session Type
<b>Saturday</b>	<b>16:40-17:40</b>	<b><i>Plenary</i></b>

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The Assessment and Improvement of Reading Comprehension in Proof-based Mathematics

*Juan Pablo Mejía-Ramos*

**Room:** Point Loma 2&3