

Agenda, Speaker Biographies & Session Summaries

seminar program

March 1-4, 2017 | Portland, Oregon



Teachers Development Group

2017 Leadership Seminar | Mathematics Professional Development





SEMINAR agenda

Wednesday March 1

2:00 pm - 6:45 pm

Seminar Check-in & Materials Pick-Up Mt. Hood Foyer

5:45 pm – 6:45 pm

Reception & Social (hors d'oeuvres, no host beverages) Mt. Hood Foyer

6:45 pm –

Welcome & Introductions Mt. Hood Ballroom

Linda Cooper Foreman

Opening Keynote

Amanda Jansen

Creating a motivating and engaging mathematics classroom climate

TEAM COLLABORATION To support and reinforce the importance of Team Collaboration, several spaces throughout the hotel have been designated specifically for Team Collaboration: Garden ABC, Garden Foyer, Cascade Foyer, St. Helen's Foyer, and Mt. Adams Foyer. If your team wants to reserve one or more tables in one of these areas for a specific window of time, please see staff members at the Seminar Registration Desk to do so.

Thursday March 2

6:45 am – 8:00 am

Breakfast & Team Collaboration Mt. Hood Foyer

8:00 am – 10:00 am

Concurrent I

Harold Asturias *Maker Projects: activating students' agency, authority, and identity (repeats during Concurrent VII)* **Mount Hood C**

Linda Ruiz Davenport, Connie Henry & Peter Thorlichen *Supporting more equitable teaching practices during math instruction (repeats during Concurrent VII)* **Mount Adams**

Mike Flynn *Unlocking the power of problem-based learning: supporting teachers in creating and implementing rich tasks (repeats during Concurrent IV)* **Cascade AB**

Grace Kelemanik & Amy Lucenta *Using routine rehearsals to transform teaching practices (repeats during Concurrent II)* **Saint Helens AB**

Linda Levi *Teaching base ten with understanding: a Cognitively Guided Instruction (CGI) approach (part I of 2, continues during Concurrent II)* **Garden AB**

Deborah Schifter *Early algebra and MP7: a focus on the operations (does not repeat)* **Mount Hood A**

Virginia (Gini) Stimpson *What helps students develop a meaning-based, visceral feel for operations with integers? (part I of 2, continues during Concurrent II)* **Saint Helens CD**

(agenda continues on next page)



Thursday Agenda (con't)

10:00 am – 10:15 am Transition (beverage and pastry refresh in **Mount Hood Foyer**)

10:15 am – 12:15 pm **Concurrent II**

Virginia Bastable *Changing the domain from whole to rational: expanding mathematical knowledge in the context of division. How is working on such ideas with adult learners similar to and different from working with elementary-aged students? (repeats during Concurrent VII)* **Mount Hood A**

Grace Kelemanik & Amy Lucenta *Using routine rehearsals to transform teaching practices (repeats Concurrent I)* **Saint Helens AB**

Linda Levi *Teaching base ten with understanding: a Cognitively Guided Instruction (CGI) approach (part 2 of 2, continues from Concurrent I)* **Garden AB**

Kendra Lomax & Elham Kazemi *Mathematical modeling in the primary grades with three-act tasks (does not repeat)* **Mount Hood C**

Elizabeth Phillips and Yvonne Grant *Arc of Learning framework: developing conceptual understanding (repeats during Concurrent VI)* **Cascade AB**

Mike Shaughnessy, Kate Melhuish, Eva Thanheiser & Julie Fredericks *The Math Habits & Routines Classroom Observation Tool: connecting teacher moves and student reasoning (repeats during Concurrent VI)* **Mount Adams**

Virginia (Gini) Stimpson *What helps students develop a meaning-based, visceral feel for operations with integers? (part 2 of 2, continues from Concurrent I)*

12:15 pm – 1:30 pm Lunch, Team Collaboration & Networking **Mount Hood Ballroom**

1:30 pm – 3:00 pm **Plenary A** **Mount Hood Ballroom**

Kristen Bieda
Engaging students in justification is teaching for equity!

3:00 pm – 3:15 pm Transition (beverage refresh in **Mount Hood Foyer**)

3:15 pm – 5:15 pm **Concurrent III**

Diane Briars *Strategies and tasks to build procedural fluency from conceptual understanding (does not repeat)* **Garden AB**

Anurupa Ganguly *Developing 'Function Sense' for teachers and students through the art of conjecturing (repeats during Concurrent IV)* **Mount Hood**

Lynsey Gibbons *Using Number Talks to support student and teacher learning across a system (repeats during Concurrent VI)* **Saint Helens CD**

Ruth Heaton, Michelle Metzger & Molly Williams *Capitalizing on the visibility of practice within Math Studio to understand teachers and coaches as learners (repeats during Concurrent IV)* **Mount Hood A**



Thursday Agenda (con't)

Vicki Jacobs & Susan Empson *Exploring the characteristics of one-on-one conversations with children when teachers circulate during problem-solving (repeats during Concurrent V)* **Saint Helens AB**

Cathy Martin *Mathematical modeling: an evolving perspective (repeats during Concurrent VII)* **Cascade AB**

Nanette Seago & Koellner *How does video-based professional development influence teacher practice? (repeats during Concurrent V)* **Mount Adams**

5:15 pm – 6:30 pm

Team Collaboration, Networking & Social

Team Collaboration Sites: **Garden ABC, Garden Foyer, Cascade Foyer, Mount Adams Foyer, and St. Helen's Foyer**

Networking & Social (no host beverages): **Mount Hood Foyer**

6:30 pm –

Banquet & Networking **Mount Hood Ballroom**

Drawings for an iPad Mini and copies of several NCTM professional resources

Friday March 3

6:45 am – 8:00 am

Team Collaboration: **Garden ABC, Garden Foyer, Cascade Foyer, St. Helen's Foyer, and Mount Adams Foyer**

Breakfast: **Mt. Hood Foyer**

8:00 am – 10:00 am

Concurrent IV

Mary Beisiegel *To know or not know? To lead or not lead? Important questions and findings from a video-based professional development study (part 1 of 2, continues during Concurrent V)* **Garden AB**

Diane Briars *Adopting new math books? Start by selecting an effective textbook analysis toolkit to inform your work! (does not repeat)* **Mount Hood A**

Mike Flynn *Unlocking the power of problem-based learning: supporting teachers in creating and implementing rich tasks (repeats Concurrent I)* **Cascade AB**

Anurupa Ganguly *Developing 'Function Sense' for teachers and students through the art of conjecturing (repeats Concurrent III)* **Mount Hood C**

Ruth Heaton, Michelle Metzger & Molly Williams *Capitalizing on the visibility of practice within Math Studio to understand teachers and coaches as learners (repeats Concurrent III)* **Saint Helens AB**

Amanda (Mandy) Jansen *Rough draft thinking: points of entry & deeper dive (repeats during Concurrent VI)* **Mount Adams**

Amy Lucenta & Grace Kelemanik *Construct and critique: an instructional routine (repeats during Concurrent V)* **Saint Helens CD**

10:00 am – 10:15 am Transition (beverage and pastry refresh in **Mount Hood Foyer**)

(agenda continues on next page)



Friday Agenda (con't)

10:15 am – 12:15 pm

Concurrent V

Mary Beisiegel *To know or not know? To lead or not lead? Important questions and findings from a video-based professional development study (part 2 of 2, continues from Concurrent IV)* **Garden AB**

Kristen Bieda *Share your knowledge in the Mathematics Teacher Educator (repeats during Concurrent VI)* **Mount Hood C**

Hilda Borko & Anthony Villa *Preparing teacher leaders to facilitate video-based discussions in mathematics professional development (repeats during Concurrent VII)* **Saint Helens AB**

Vicki Jacobs & Susan Empson *Exploring the characteristics of one-on-one conversations with children when teachers circulate during problem-solving (repeats Concurrent III)* **Cascade AB**

Amy Lucenta & Grace Kelemanik *Construct and critique: an instructional routine (repeats Concurrent IV)* **Saint Helens CD**

Susan Jo Russell & Deborah Schifter *Mathematical argument in the elementary classroom: a model for teachers and coaches (repeats during Concurrent VI)* **Mount Hood A**

Nanette Seago & Koellner *How does video-based professional development influence teacher practice? (repeats Concurrent III)* **Mount Adams**

12:15 pm – 1:30 pm

Lunch, Team Collaboration & Networking **Mount Hood Ballroom**

1:30 pm – 3:00 pm

Plenary B **Mount Hood Ballroom**

Elham Kazemi and Kendra Lomax
Leading productive mathematical discussions

3:00 pm – 3:15 pm

Transition (beverage refresh in **Mount Hood Foyer**)

3:15 pm – 5:15 pm

Concurrent VI

Kristen Bieda *Share your knowledge in the Mathematics Teacher Educator (repeats Concurrent V)* **Garden AB**

Lynsey Gibbons *Using Number Talks to support student and teacher learning across system (repeats Concurrent III)* **Cascade AB**

Amanda (Mandy) Jansen *Rough draft thinking: points of entry & deeper dive (repeats Concurrent IV)* **Mount Hood C**

Kelemanik, Lucenta, Kuokkanen & Paquette *Coaching so it sticks: leveraging instructional routines to develop math teaching practices (does not repeat)* **Saint Helens AB**

(agenda continues on next page)



Friday Agenda (con't)

Elizabeth Phillips and Yvonne Grant *Arc of Learning framework: developing conceptual understanding (repeats Concurrent II)* **Saint Helens CD**

Susan Jo Russell & Deborah Schifter *Mathematical argument in the elementary classroom: a model for teachers and coaches (repeats during Concurrent V)*
Mount Hood A

Mike Shaughnessy, Kate Melhuish, Eva Thanheiser & Julie Fredericks *The Math Habits & Routines Classroom Observation Tool: connecting teacher moves and student reasoning (repeats Concurrent II)* **Mount Adams**

5:15 pm – Team Collaboration, Networking & Dinner (on your own)

Saturday March 4

6:45 am – 8:00 am Breakfast & Team Collaboration **Mt. Hood Foyer**

8:00 am – 10:00 am **Concurrent VII**

Harold Asturias *Maker Projects: activating students' agency, authority, and identity (repeats Concurrent I)* **Saint Helens AB**

Virginia Bastable *Changing the domain from whole to rational: expanding mathematical knowledge in the context of division. How is working on such ideas with adult learners similar to and different from working with elementary-aged students? (repeats Concurrent II)* **Cascade AB**

Hilda Borko & Anthony Villa *Preparing teacher leaders to facilitate video-based discussions in mathematics professional development (repeats Concurrent V)*
Saint Helens CD

Linda Ruiz Davenport, Connie Henry & Peter Thorlichen *Supporting more equitable teaching practices during math instruction (repeats Concurrent I)* **Mount Adams**

Cathy Martin *Mathematical modeling: an evolving perspective (repeats Concurrent III)* **Garden AB**

Susan Jo Russell *Focusing on equity while engaging elementary students in mathematical practices (does not repeat)* **Mount Hood A**

10:00 am – 10:30 am Transition & Networking (beverage and pastry refresh in **Mount Hood Foyer**)

10:30 am – 12:00 pm **Plenary C** **Mount Hood Ballroom**

Laura Van Zoest
Building on MOSTs

12:15 pm – 1:45 pm

Seminar Closing **Mount Hood Ballroom**

Lunch, Team Collaboration, Networking, and Closing

Drawings for an iPad Mini and copies of several NCTM professional resources!



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speaker biographies

about Harold Asturias

Concurrents I & VII Maker projects: activating students' agency, authority, and identity

Harold Asturias is the director of the Center for Mathematics Excellence and Equity (CeMEE) at the Lawrence Hall of Science, a science center located at the University of California, Berkeley. Before that, he was the Deputy Director of Mathematics and Science Professional Development at the University of California Office of the President. He provided oversight to the English Language Development Professional Development Institutes (ELD-PDI). Previously, he served as the Director of the New Standards Portfolio Assessment Project and the Mathematics Unit for New Standards—a national project to develop national standards and assessments. In that capacity he led the development team of experts whose efforts involved many states and over a thousand teachers and resulted in the successful production of two assessment systems: the New Standards Portfolio and the Reference Examination. In addition, he was part of the team that produced the New Standards Performance Standards. Mr. Asturias was a member of the writing group for the National Council of Teachers of Mathematics *Assessment Standards for School Mathematics*. He has extensive experience providing professional development in the areas of standards and assessment in mathematics for teachers in large urban districts (Chicago, Los Angeles, New York City) and smaller and rural districts. Over the past few years he has focused in the area of designing and implementing professional development for K-12 mathematics teachers who teach English Language Learners. Harold is currently a member of the Teachers Development Group Board of Directors.

about Virginia Bastable

Concurrents II & VII Changing the domain from whole to rational: expanding mathematical knowledge in the context of division. How is working on such ideas with adult learners similar to and different from working with elementary-aged students?

Dr. Virginia Bastable is the Associate Director of the Mathematics Leadership Programs (MLP, formerly SummerMath for Teachers) at Mount Holyoke College. MLP conducts a set of coordinated professional development seminars examining the learning and teaching of mathematics each summer, offers school year on-line courses for math coaches and classroom teachers, and provides math consulting and programs to school systems. MLP also offers a Masters of Arts in Mathematics Teaching (MAMT) for practicing teachers, facilitation institutes to support the implementation of Developing Mathematical Ideas (DMI) seminars, and professional development programs for math coaches.

With Deborah Schifter of EDC and Susan Jo Russell of TERC, Virginia is an author of the *DMI Professional Development Curriculum* being published by NCTM and two books published by Heinemann on mathematical reasoning about the operations, *Connecting Arithmetic to Algebra*, and the up-coming, *But Why Does it Work? Mathematical Argument in the Elementary Classroom*. She also contributed to the third edition of *Investigations in Number, Data and Space*. Her current work includes: adapting the seven modules of the DMI professional development series to highlight links to the Common Core; designing hybrid DMI seminars that combine face-to-face and online instruction through an interactive approach; and working with math coaches to support their work as teacher leaders.



about Mary Beisiegel

Concurrents IV-V To know or not know? To lead or not lead? Important questions and findings from a video-based professional development study

Dr. Mary Beisiegel is an assistant professor of mathematics at Oregon State University. Her teaching consists primarily of content courses for future teachers and graduate mathematics education courses. Mary's research focuses on the study of mathematics teaching, including her own teaching, and video-based professional development. She is also an affiliated researcher at the National Center for Teacher Effectiveness through the Harvard Graduate School of Education, working with Dr. Heather Hill's instrument development group. Her work includes using the Mathematical Quality of Instruction (MQI) instrument to observe teaching.

Mary has worked as a co-PI with Dr. Heather Hill and Dr. Rebecca Mitchell on the NSF funded project Exploring Methods for Improving Teachers' Mathematical Quality of Instruction. Through this study, the researchers are hoping to answer the following questions: In using clips of instruction for professional development purposes, is it more informative for teachers to watch their own or their peers' lessons or lessons from unknown teachers? How is video-based professional development best structured, either with an active, involved facilitator or with teachers facilitating conversations?

about Kristen Bieda

Plenary A Engaging students in justification is teaching for equity!

Concurrents IV & V Share your knowledge in the mathematics teacher educator

Kristen Bieda is an Associate Professor of Teacher Education at Michigan State University. She also holds the appointment of Associate Director for Mathematics for the CREATE for STEM Institute at MSU. Her current research focuses primarily on the design and development of field experiences that support prospective teachers in learning to teach. She is also co-PI of grants awarded through National Science Foundation and W.T. Grant Foundation to explore how early career elementary teachers' school-based social networks and district influence impact their mathematics classroom practice. She is also currently a LessonSketch fellow, with funding to develop rich media experiences for teacher education through the LessonSketch platform that support teachers' understanding of enacting the Common Core Standard for Mathematical Practice 3 (Generating Arguments and Critiquing the Reasoning of Others). Along with Courtney Koestler, Mathew Felton-Koestler, and Samuel Otten, she co-authored a best-selling book on connections between the NCTM Process Standards and the Common Core Standards for Mathematical Practice published by NCTM in 2013.

Also in 2013, Dr. Bieda was awarded the Early Career Publication Award by the AERA SIG-Research in Mathematics Education for her paper "Challenges and Opportunities: Enacting Proof-Related Tasks in Middle School Mathematics" published in *Journal for Research in Mathematics Education* in 2010. In 2014, she was among six scholars at Michigan State awarded the Teacher-Scholar Award, nominated by her department and MSU's College of Education for outstanding achievements in teaching, research and service. She is currently Associate Editor of *Mathematics Teacher Educator*, a joint publication of NCTM and AMTE focusing on building a knowledge



base for the practice of mathematics teacher education. She is actively engaged with local schools, particularly with her work facilitating lesson study as a tool for department-level growth and collaboration between mentor and early career teachers. Most recently, she has served as subject area leader for MSU's secondary mathematics teacher preparation program and worked side-by-side as a field instructor with mentor teachers and teacher candidates across the state of Michigan.

about Hilda Borko

Concurrent V & II Preparing teacher leaders to facilitate video-based discussions in mathematics professional development (co-speaking with Anthony Villa)

Dr. Hilda Borko is a professor of education at Stanford University, where she serves as Chair of the Curriculum and Teacher Education program area. Her research explores the process of learning to teach, with an emphasis on changes in novice and experienced teachers' knowledge and beliefs about teaching and learning, and their classroom practices, as they participate in teacher education and professional development programs. With colleagues Karen Koellner (Hunter College) and Jennifer Jacobs (University of Colorado), Dr. Borko developed the Problem-Solving Cycle (PSC) model of mathematics professional development and Mathematics Leadership Preparation (MLP) model for preparing PSC facilitators. The PSC is a long-term approach to mathematics PD designed to increase teachers' mathematics knowledge for teaching (MKT), improve their instructional practices, and foster student achievement gains. Their book, *Mathematics Professional Development: Improving Teaching Using The Problem-Solving Cycle And Leadership Preparation Models* (Borko, Jacobs, Koellner, & Swackhamer, 2015), describes the two models, summarizes key research findings, provides detailed examples of workshop activities, and shares lessons learned. It is written for an audience of school leaders and other professional development providers. Dr. Borko's current NSF-funded project with Janet Carlson (Stanford), *Refining a Model with Tools to Develop Mathematics Professional Development Leaders: An Implementation Study*, is a partnership with a local urban school district to adapt and implement the two models. She is also collaborating with colleagues Matt Kloser (Notre Dame) and Jonathan Osborne (Stanford) on projects studying PD in science classrooms.

Dr. Borko is a member of numerous professional organizations in education and psychology. She served as President of the American Educational Research Association (AERA; 2003-2004). She is a member of the National Academy of Education and was editor of *Journal of Teacher Education* (with Drs. Dan Liston and Jennie Whitcomb). She is the 2014 recipient of the Excellence in Scholarship in Mathematics Teacher Education Award, AMTE.





about Diane Briars

Concurrent III Strategies and tasks to build procedural fluency from conceptual understanding

Concurrent IV Adopting new math books? Start by selecting an effective textbook analysis toolkit to inform your work!

Diane J Briars is a mathematics education consultant and immediate past president of the National Council of Teachers of Mathematics (NCTM), a 70,000-member international mathematics education organization. Previously, she was a senior developer and research associate on the NSF-funded Intensified Algebra Project, a joint venture of the Learning Science Research Institute at the University of Illinois at Chicago, the Dana Center at the University of Texas at Austin, and the technology company AgileMind to develop instructional materials for underprepared ninth-grade Algebra I students. Briars was also mathematics director for Pittsburgh Public Schools for twenty years, leading efforts to increase students' achievement through standards-based curricula, instruction, and assessment.

Dr. Briars is a past president of the National Council of Supervisors of Mathematics (NCSM) and has served in leadership roles in various other national organizations, including the Conference Board for the Mathematical Sciences (CBMS), the Consortium for Mathematics and its Applications (COMAP), Illustrative Mathematics, the College Board, the New Standards Project, and the Mathematical Sciences Education Board of the National Research Council.

Briars holds a Ph.D. in Mathematics Education, M.S. and B.S. in Mathematics from Northwestern University and did post-doctoral study in the Psychology Department of Carnegie-Mellon University. She began her career as a secondary mathematics teacher.

about Linda Ruiz Davenport

Concurrents I & VII Supporting more equitable teaching practices during math instruction (co-speaking with Connie Henry & Peter Thorlichen)

Linda Ruiz Davenport is currently the Director of K-12 Mathematics for the Boston Public School (BPS) and is responsible for supporting mathematics teaching and learning across the district. This includes ensuring that all teachers have access to high-quality mathematics curriculum materials that align to the CCSSM, supporting the use of effective formative assessment strategies to monitor student learning, the creation of a professional development program for teachers, teacher leaders, and principals designed to support their ongoing learning, as well as providing school-based support for mathematics teaching and learning in selected contexts. Over these past few years, the BPS has received recognition for its gains in mathematics performance on the MCAS state assessment and NAEP, as well as its strong leadership in mathematics teaching and learning.

Prior to taking a position with the Boston Public Schools, Davenport was a middle school and high school mathematics teacher for the Austin Independent School District, a Mathematics Specialist for a Bilingual Education Service Center for the Northwest, Assistant Professor of Mathematics Education at Portland State University, and a project director at the Education Development Center in Newton, Massachusetts. She chaired the NCTM



Emerging Issues Committee during the development of the CCSSM, served as editor of the NCSM *Journal of Mathematics Education Leadership* and a member of the NCSM Board, and has just been elected to serve as a member at large on the NCTM Board of Directors. She has a PhD in Curriculum and Instruction from the University of Washington with a focus on mathematics education and bilingual education and is an active member of NCTM, NCSM, TODOS, and the Urban Mathematics Leadership Network. Linda also served for 5 years (2008-2013) on the Teachers Development Group Board of Directors.

about Susan Empson

Concurrents III & V Exploring the characteristics of one-on-one conversations with children when teachers circulate during problem-solving (co-speaking with Vicki Jacobs)

Susan B. Empson is a professor and Richard Miller endowed chair of mathematics education in the department of Learning, Teaching, and Curriculum at the University of Missouri. She and Vicki Jacobs are currently collaborating on a National Science Foundation research grant to study elementary teachers' learning and development centered on teaching in ways that are responsive to children's mathematical thinking in the domain of rational numbers. Her research on children's thinking about fractions is the topic of her 2011 book, *Extending Children's Mathematics: Fractions and Decimals* (co-authored with Linda Levi) and she has published widely in refereed journals, including *Cognition and Instruction*, *Journal for Research in Mathematics Education*, *Educational Studies in Mathematics*, *Teaching Children Mathematics*, and *Journal of Mathematics Teacher Education*. She has been a researcher of Cognitively Guided Instruction since 1989 and is a co-author of *Children's Mathematics: Cognitively Guided Instruction* (1st and 2nd editions). She earned her PhD in Mathematics Education at the University of Wisconsin-Madison and before moving to Mizzou spent 20 years on the faculty at The University of Texas at Austin. Before going back to graduate school, she was a high school mathematics teacher in New York City and in the Peace Corps, in Morocco.

about Mike Flynn

Concurrents I & IV Unlocking the power of problem-based learning: supporting teachers in creating and implementing rich tasks

Mike Flynn is the director of Mathematics Leadership Programs at Mount Holyoke College, where he runs the Master of Arts in Mathematics Teaching program and leads a wide variety of professional learning opportunities for teachers, teacher-leaders, coaches, administrators, and staff-developers. This work connects him with educators from around the world who are interested in the learning and teaching of mathematics. Mike also teaches the elementary mathematics, science, and technology methods course for undergraduates in the teacher licensure program. Mike is the author of *Beyond Answers: Exploring Mathematical Practices with Young Children*.

Mike's latest work in higher education centers on creating more interactive and engaging online learning. He designed the dynamic hybrid learning model that blends on-campus and online students for live, interactive learning in mathematics. He also created the Virtual Math Professional Learning Community (#VMathPLC) connecting teachers and math coaches to study current and engaging topics in math education.

Prior to this work Mike taught second grade at the William E. Norris Elementary School in Southampton, MA for 14 years.



about Linda Cooper Foreman

Welcome and Keynote/Plenary Introductions

Linda Cooper Foreman is the President and Executive Director of Teachers Development Group (TDG), a nonprofit organization (founded in 1998) whose mission is to improve students' mathematical understanding and achievement through effective professional development for teachers and school leaders. In her work at TDG, Linda and her TDG colleagues collaborate with other mathematics educators and school leaders to design and implement mathematics professional development projects in diverse settings nationwide. Over her four decades of work in mathematics education, in addition to over twenty years in the field of professional development, Linda was a middle and high school teacher and recipient of the Presidential Award for Excellence in Mathematics Teaching and the Oregon Mathematics Education Lifetime Achievement Award. She has authored numerous publications in support of meaningful, equitable, and rigorous mathematics instruction and assessment, worked on numerous professional committees and working groups nationwide, served as chair of the NCTM Educational Materials Committee, and led many National Science Foundation and other grant funded professional development projects.

Much of Linda's current work focuses on the continued refinement of the Math Studio, an innovative professional development model that uses a live mathematics classroom as context for ongoing inquiry and professional learning by teachers, coaches, administrators, and researchers. The goals of Math Studio are multi-layered – fostering student understanding and internalization of mathematical habits of mind and interaction that tie directly to success with the Common Core by fostering teachers' and leaders' understanding and internalization of mathematically productive teaching/leadership routines and habits of practice. Linda is the Principal Investigator of an NSF funded research and development project studying the efficacy of the Math Studio model. She and project colleagues are currently guiding the development of the *Math Habits & Routines Classroom Observation Tool*, a tablet application that will support teachers, school leaders, and researchers in understanding and improving implementation and internalization of research-based elements of mathematics teaching and learning.

about Julie Fredericks

Concurrents II & VI The Math Habits & Routines Classroom Observation Tool: connecting teacher moves and student reasoning (co-speaking with Kate Melhuish, Eva Thanheiser, & Mike Shaughnessy)

Dr. Julie Fredericks directs math content initiatives at Teachers Development Group (TDG). Before joining TDG eight years ago, she was a mathematics professor at Linfield College. She received her Ph.D. in mathematics from Oregon State University.

Julie developed a strong interest in mathematics education while in graduate school. During her tenure as a mathematics professor, she also participated as a member of the math faculty for two Math and Science Partnership grants, one of which was the nine-year National Science Foundation funded Oregon Mathematics Leadership Institute (OMLI). Julie's experiences in the OMLI project solidified mathematics education as her primary field of interest. She and Dr. Martha VanCleave authored an article, "Student Mathematical Discourse and Team Teaching," which was based on data they collected during their involvement in the OMLI grant and



which initiated her interest in the role of sense making, justifying and generalizing in the learning and teaching of mathematics.

Julie currently oversees the development and implementation of TDG's Knowing Mathematics for Teaching seminar series and the integration of related ideas into TDG's Math Studio curriculum. She leads Math Studio work in several K-12 districts nationwide, and she collaborates with other TDG Math Studio leaders in the refinement and implementation of the Math Studio professional development model. She is also currently a co-Principal Investigator of the NSF funded DRK-12 project, Enhancing Mathematics Teaching and Learning in Urban Elementary Schools, which is studying the efficacy of the Math Studio model.

about Anurupa Ganguly

Concurrents III & IV Developing 'Function Sense' for teachers and students through the art of conjecturing

Anurupa Ganguly currently serves as the Senior Director of Instruction and Professional Learning for the Office of Field Support in the New York City Department of Education (DOE). She and her team provide leadership, support, strategic guidance and oversight to each of the 8 Borough Field Support Centers that are charged with providing comprehensive and coherent support to districts and schools in service of student achievement for all student populations. This includes the implementation of city-wide DOE policies, programs, and initiatives related to curriculum and instruction.

Prior to this role, Anurupa was a Borough Instructional Lead for Mathematics in Brooklyn. She supported mathematics teaching and learning across 5 districts through a variety of professional development opportunities for school leaders and teachers. Before stepping into this role, she was the Assistant Director of K-12 Mathematics and Director of Secondary Mathematics for the Boston Public Schools, where she worked to develop a city-wide K-12 vision for mathematics instruction and a coherent professional learning plan for all layers of the school community. A large part of her work also focused on identifying and piloting CCSS-aligned curriculum materials to make informed choices about curriculum adoptions as a district.

Prior to joining the Mathematics Office, Anurupa worked as a Program Manager for Teach for India under the organizational umbrella Teach for All. In this role, she managed and coached 1st- and 2nd-year teachers across schools in impoverished neighborhoods of Mumbai. While in the Program Manager role, she also served as the Instructional Lead for Mathematics to integrate the CCSS for Mathematics within the Indian context of curriculum and instruction. Prior to her international development work, Anurupa was a physics and mathematics high school teacher in the Boston Public Schools. She holds bachelors and masters degrees in electrical engineering from Massachusetts Institute of Technology. She also holds a masters degree in education from Boston University.



about Lynsey Gibbons

Concurrents III & VI Using Number Talks to support student and teacher learning across a system

Lynsey Gibbons began her career in Lexington, Kentucky where she taught upper elementary grades and was a mathematics coach. A curiosity about students' thinking and how to support teachers' ongoing learning led her to pursue graduate studies in mathematics education at Vanderbilt University. While there, she studied how districts organized mathematics coaching to support middle grades teachers. Lynsey became curious about how coaches could be better supported to assist teachers in developing their teaching practices. This led her to a postdoctoral fellowship at the University of Washington, where she had the opportunity to explore the work of coaches as they aimed to help all teachers across their elementary schools develop and hone their teaching of mathematics. In this work, coaches implemented "Math Labs," which is full day professional learning opportunity for teachers led by their coach. During the Math Lab teachers have time to consider particular mathematical ideas, examine the research on student thinking, and develop their skills at creating rich discourse communities in their classrooms. Math Labs is similar to Lesson Study in that there is a classroom visit component where coaches and teachers can bring to life the lessons that they have planned together; the classroom visits provide the participants opportunities to learn about teaching as engage in teaching together. Working alongside other mathematics educators, Lynsey helped adapt tools and resources for coaches and principals to use when implementing Math Labs in their own schools.

Now Lynsey is an assistant professor of mathematics education at Boston University. With funding from local organizations, she has partnered with the district leaders at Boston Public Schools and surrounding districts to engage teachers, coaches, and principals in Math Labs. Together, we are exploring ideas about how to best support teacher and student learning.

Lynsey's research on coaching has been published in *Elementary School Journal*, *Journal of Teacher Education*, and the *Journal of Mathematical Behavior*. Her work with coaches and mathematics educators to create tools to support school-wide learning have been published in NCTM's publications, *Teaching Children Mathematics* and *Mathematics Teaching in the Middle School*, as well as *Educational Leadership* and the *Journal of Staff Development*. She continues to be interested in how to reorganize coaching and teacher leadership in service of school-wide learning and improvement, as well as the roles that principals play in that organization.

about Yvonne Grant

Concurrents II & VI Arc of Learning framework: developing conceptual understanding (co-speaking with Elizabeth Phillips)

Yvonne Grant is a middle school teacher from Portland, MI. Currently, she works as Teacher in Residence and Professional Development Coordinator for the *Connected Mathematics Project* (CMP) office at Michigan State University. Yvonne has held various roles in her many years in education including middle school mathematics teacher, elementary teacher, instructional coach, professional development consultant, developer and field tester of *Connected Mathematics*, and more. Yvonne has assisted school districts and systemic initiatives in many states with the implementation of standards-based curricula.



Yvonne's goal in education has always been to find ways to maximize learning, teaching, assessing, planning, and reflecting to enhance the learning of mathematics.

Yvonne is involved in the research projects at CMP, which include:

1. The Student Work in Curriculum Materials Research Project,
2. The Arc of Learning Research Project,
3. Formative Assessment Research Project, and
4. Enhancing Students' Capacity to Develop and Communicate Their Understanding Using Digital Inscriptional Resources: an NSF-funded project.

about Ruth Heaton

Concurrents III & IV Capitalizing on the visibility of practice within Math Studio to understand teachers and coaches as learners (co-speaking with Michelle Metzger & Molly Williams)

Dr. Ruth Heaton is a professor in the Department of Teaching, Learning and Teacher Education at the University of Nebraska-Lincoln (UNL). Her main research interests are in preK-8 mathematics education, including research on teaching, teacher learning, and teacher knowledge. Heaton has done all of her work in close interdisciplinary collaboration with mathematicians since 2000. Heaton has extensive experience as PI or co-PI of externally funded research and professional development projects in mathematics education. Since 2009, Heaton has been co-PI for NebraskaMATH, a NSF-funded project aimed at improving achievement in mathematics for all students by focusing on key transition points along the K-12 mathematics curriculum in urban and rural schools across Nebraska.

Within NebraskaMATH, Heaton has led the development and research for Primarily Math, a K-3 professional development and research project aimed at helping primary teachers become more intentional, planful, observant, and reflective. Currently, Heaton is co-PI for the Omaha Public Schools Teacher Leader Academy, a grant from the Sherwood and Lozier Foundations in Omaha, NE. The purpose of this grant is to study and advance the process of improving teaching and learning in mathematics education in the Omaha Public Schools. Heaton is also PI, working with UNL colleagues in early childhood education, and the recipient of extensive funding from the Buffett Early Childhood Fund to support a professional development and research project in mathematics education called Math Early On. The goal of this project is to improve mathematics teaching and learning for three to five year old children in Nebraska Educare preschools.

As a leader on UNL's campus in interdisciplinary partnerships, Heaton is currently a co-PI for ARISE: Adapting Research-based Instructional Strategies for Enhancing STEM Education, a NSF-funded project with the goal of improving undergraduate teaching practices across UNL's STEM disciplines. Heaton's main role on this three-year project is to work closely with UNL STEM department chairs to support the improvement of teaching among faculty and study department chairs' learning.

Heaton recently accepted the position offered to her to become the Chief Executive Officer of Teachers Development Group. She will begin her new position August 1, 2017.



about **Connie Henry**

Concurrents I & VII Supporting more equitable teaching practices during math instruction (co-speaking with Linda Ruiz Davenport & Peter Thorlichen)

Connie Henry is Assistant Director of K-12 Mathematics for Boston Public Schools with a focus on the primary and elementary grades. Teacher leadership work is currently focused on equity and access for all students this year and beyond. She was a teacher for several decades, having taught grades PreK-6 th . She teaches a blended learning course focused on integrating the Standards for Mathematical Practice with the content standards for elementary teachers at Wheelock College.

Previously she has worked for the Boston Teacher Residency and the Boston Plan for Excellence, as well as being a math coach in several BPS schools. She was involved in the NCTM-Hunt Institute video collaboration to support parents in learning about the Common Core practice and content standards. She has presented at NCTM, NCSM, The National Family and Community Engagement Conference, and the Teachers Development Group.

about **Vicki Jacobs**

Concurrents III & V Exploring the characteristics of one-on-one conversations with children when teachers circulate during problem-solving (co-speaking with Susan Empson)

Vicki Jacobs is the Yopp Distinguished Professor of Mathematics Education at the University of North Carolina at Greensboro. For more than two decades, she has worked with the Cognitively Guided Instruction (CGI) project which introduced her to the wonder and power of children's thinking. Her research interests center on children's mathematical thinking and how to support teachers in using children's thinking as the foundation for instructional decisions. She and Susan Empson are currently collaborating on a multi-institution project funded by the National Science Foundation to investigate how upper elementary school teachers learn to teach in ways that are responsive to children's fraction thinking. She has extensive experience facilitating professional development for teachers and is particularly interested in long-term collaborations with teachers and school districts. She earned her PhD at the University of Wisconsin, spent most of her academic career at San Diego State University and the Center for Research in Mathematics and Science Education, and is now enjoying learning about mathematics education in North Carolina.

about **Amanda Jansen**

Opening Keynote Creating a motivating and engaging mathematics classroom climate

Concurrents IV & VI Rough draft thinking: points of entry & deeper dives

Amanda (Mandy) Jansen is a former middle school mathematics teacher and is currently an Associate Professor in the School of Education at the University of Delaware in the mathematics education program area. Mandy earned her Ph.D. in Educational Psychology from Michigan State University. She now teaches prospective elementary and middle school mathematics teachers and advises and teaches doctoral students.



Mandy's expertise is in the areas of motivation and engagement as well as teacher education. In 2011, NCTM published her book, *Motivation Matters and Interest Counts*, which she co-authored with Jim Middleton at Arizona State University. Her research on motivation and engagement focuses on capturing students' voices about what motivates and engages them, to build classroom communities that honor students' perspectives. Her prior presentations at TDG Leadership Seminars have focused on students' perspectives on their motivation as well as rough draft talk and her sessions during this seminar will take a "deeper dive" into those topics. NCTM published a recent article (January, 2017) in *Mathematics Teaching in the Middle School* about rough draft talk that Mandy co-wrote with three Delaware middle school teachers. Mandy also recently joined the Teachers Development Group Board of Directors.

about Elham Kazemi

Plenary B Leading productive mathematical discussions (co-speaking with Kendra Lomax)

Concurrent II Mathematical Modeling in the Primary Grades with Three-Act Tasks (co-speaking with Kendra Lomax)

Elham Kazemi is a professor of mathematics education at the University of Washington. She loves to design professional learning opportunities for teachers, coaches, and principals to learn together about children's mathematical thinking. Currently, she is working on two different projects. The first one focuses on supporting coaches and principals to become strong instructional leaders. And the second project involves colleagues at University of Washington, Northwestern, and the Teaching Channel. Together, they are designing online courses for K-2 teachers to learn about modeling and argumentation in mathematics and science. She is co-author with Allison Hintz of *Intentional Talk*. middle school mathematics teachers and advises and teaches doctoral students.

about Grace Kelemanik

Concurrents I & II Using routine rehearsals to transform teaching practices (co-speaking with Amy Lucenta)

Concurrent IV & V Construct and critique: an instructional routine (co-speaking with Amy Lucenta)

Concurrent VI Coaching so it sticks: leveraging instructional routines to develop math teaching practices (co-speaking with Grace Kelemanik, Sonja Kuokkanen, & Nataliya Paquette)

Grace Kelemanik has more than 30 years of mathematics education experience. A frequent presenter at national conferences, her work focuses on urban education, special populations, and teacher training. She is a former urban high school mathematics teacher and Project Director at Education Development Center. Grace has also worked extensively with new and preservice teachers through the Boston Teacher Residency program. Most recently, Grace is the coauthor of *Routines for Reasoning: Fostering the Mathematical Practices in All Students*. She is a mathematics education consultant and professional development provider. Follow Grace on Twitter @GraceKelemanik



about Karen Koellner

Concurrents III & V How does video-based professional development (PD) influence teacher practice? (co-speaking with Nanette Seago)

Karen Koellner is a professor in mathematics education at Hunter College. Her program of research is focused on teacher learning and professional development interventions and their impact on teachers and students. She currently serves as co-PI for the DRK-12 NSF grant, An Efficacy Study of the Learning and Teaching Geometry PD Materials: Examining Impact and Context-Based Adaptations. From 2007-2014, she was a co-PI on another NSF DRK12 grant, Toward a Scalable Model of Mathematics Professional Development: A Field Study of Preparing Facilitators to Implement the Problem-Solving Cycle. From 2003-2007, she served as a co-PI on an IERI grant, Understanding and Cultivating the Transition from Arithmetic to Algebraic Reasoning. Koellner has collaborated extensively with Hilda Borko, Jennifer Jacobs, and Nanette Seago.

Over the past 20 years, Koellner has published numerous peer-reviewed manuscripts and chapters as well as presenting at national and international conferences. She recently co-authored a book with Borko and Jacobs, *Mathematics Professional Development: Improving Teaching Using the Problem-Solving Cycle (PSC) and Leadership Preparation Models*. This book is a culmination of 10 years of their work including the development of the PSC and the Teacher Preparation Model as well as research on impact of the PSC on students' achievement, teachers' knowledge and instructional practices. Koellner and Jacobs recently won the 2017 Distinguished Research Award in Teacher Education granted by the Association of Teacher Education.

about Sonja Kuokkanen

Concurrent VI Coaching so it sticks: leveraging instructional routines to develop math teaching practices (co-speaking with Grace Kelemanik, Amy Lucenta, & Nataliya Paquette)

Sonja Kuokkanen has been teaching and coaching middle school and high school mathematics for over 15 years. She is currently working as a Math Coach in Lexington, MA supporting middle school math teachers and where she has been involved in a professional development project with Grace Kelemanik and Amy Lucenta.

about Linda Levi

Concurrents I-II Teaching base ten with understanding: a cognitively guided instruction (CGI) approach

Linda Levi is the Director of Cognitively Guided Instruction (CGI) Initiatives for Teachers Development Group. She designs and supports CGI professional development for elementary school teachers and teacher leaders nationwide. She also directs the development of local CGI leaders who provide CGI professional development on a wide-scale basis. In addition to working with school districts and education cooperatives to develop CGI teachers and teacher leaders, she is working on statewide initiatives to develop CGI leaders with the Arkansas Department of Education and the Iowa Department of Education. Dr. Levi has been a member of the CGI



research and development team since 1989 and is a co-author of *Children's Mathematics: Cognitively Guided Instruction*, *Thinking Mathematically: Integrating Arithmetic and Algebra in Elementary School* and *Extending Children's Mathematics: Fractions and Decimals*. She worked on the development and research of the CGI number and operation professional development program as well as the CGI algebra professional development program.

about Kendra Lomax

Plenary B Leading productive mathematical discussions (co-speaking with Elham Kazemi)

Concurrent II Mathematical modeling in the primary grades with three-act tasks (co-speaking with Elham Kazemi)

Kendra Lomax is a teacher educator at the University of Washington. She collaborates with local teachers to learn about children's mathematical thinking and designs job-embedded professional learning opportunities through projects like Teacher Education by Design (TEDD.org). Curiosity about children's mathematical ideas is at the heart of her work. Currently, she is working with colleagues at University of Washington, Northwestern, and the Teaching Channel to design online courses for K-2 teachers to learn about modeling and argumentation in mathematics and science.

about Amy Lucenta

Concurrents I & II Using routine rehearsals to transform teaching practices (co-speaking with Grace Kelemanik)

Concurrents IV & V Construct and critique: an instructional routine (co-speaking with Grace Kelemanik)

Concurrent VI Coaching so it sticks: leveraging instructional routines to develop math teaching practices (co-speaking with Grace Kelemanik, Sonja Kuokkanen, & Nataliya Paquette)

Amy Lucenta has extensive K-12 mathematics experience with a focus on developing the standards for mathematical practice in all students, particularly in struggling learners. She supports teachers, districts, and educational collaborative organizations as they transition their curriculum and pedagogy to reflect current mathematics education research through professional development and coaching. A former middle school and high school teacher and elementary math coach, Amy most recently worked as a secondary mathematics Clinical Teacher Educator for the Boston Teacher Residency Program. She is the co-author of *Routines for Reasoning: Fostering Mathematical Practices in All Students*, published by Heinemann. Follow Amy on Twitter @AmyLucenta



about Cathy Martin

Concurrents III & VII Mathematical modeling: an evolving perspective

Cathy Martin was recently named the Executive Director of Curriculum and Instruction for Denver Public Schools. Prior to this, Cathy served as the K-12 Director of Mathematics. In this role, she led standards implementation in mathematics and coordinated the design of professional development for teachers, teacher leaders, and school leaders. Cathy co-directed a National Science Foundation-funded project that supported school leadership teams across five states in implementing standards-based mathematics. She has taught middle school and high school mathematics in Texas, Virginia, and Colorado. Cathy is currently on the NCTM Board of Directors and serves as Past-President of the Colorado Council of Teachers of Mathematics. She is active in the Council of Great City Schools where she serves on the mathematics advisory board and in the Urban Mathematics Leaders Network. Cathy is also a member of the Teachers Development Group Board of Directors.

about Kate Melhuish

Concurrents II & VI The Math Habits & Routines Classroom Observation Tool: connecting teacher moves and student reasoning (co-speaking with Julie Fredericks, Eva Thanheiser, & Mike Shaughnessy)

Kate Melhuish is an Assistant Professor in the Mathematics Department at Texas State University and is a former Postdoctoral Research Fellow at Teachers Development Group. She is currently working on an NSF-funded project studying the efficacy of the TDG Math Studio model in a mid-sized urban school district. Within this research, Kate studies teachers' conceptions and noticings around the practices of justifying and generalizing. Additionally, the research team is analyzing factors that may contribute to buy-in and ultimately implementation of the student-centered model for productive mathematical classrooms. This includes both careful case study analysis of teacher beliefs, exploration of the role of leadership, and the development of an implementation tool for classroom observation.

In addition to her work with TDG, Kate also studies student understanding in advanced mathematics. She has developed a Group Theory concept assessment and contributed a design process for standardized instruments with emphasis on connecting to genuine student thinking. Her work across grade-bands emphasizes a focus on student reasoning and providing teachers with the tools to leverage student thinking in a genuine manner.

about Michelle Metzger

Concurrents III & IV Capitalizing on the visibility of practice within Math Studio to understand teachers and coaches as learners (co-speaking with Ruth Heaton & Molly Williams)

Michelle Metzger is currently a doctoral student at the University of Nebraska-Lincoln. She began her teaching career in Nashville, Illinois, teaching various elementary grade levels and subjects. Her interest in students mathematical thinking and understanding led to teaching mathematics to middle and high school students in Lincoln, NE. After completing a master's degree at the University of Nebraska-Lincoln, she started teaching



Middle School Math Methods at Concordia University, Seward, NE. Since becoming a full-time doctoral student at the University of Nebraska-Lincoln, Michelle has had the opportunity to teach Elementary Math Methods and work with Dr. Ruth Heaton and current teachers through Math Studio. She is currently working on her dissertation proposal. Her research interests involve investigating preschool students' spatial reasoning as well as their overall problem solving skills.

about Nataliya Paquette

Concurrent VI Coaching so it sticks: leveraging instructional routines to develop math teaching practices (co-speaking with Grace Kelemanik, Amy Lucent, & Sonja Kuokkanen)

Nataliya Paquette has more than 15 years of education experience, concentrating primarily on middle school mathematics instruction. She is a former Boston Public Schools teacher and is currently a middle school math coach in Lexington, Massachusetts where she is also involved in a professional development project with Grace Kelemanik and Amy Lucenta. Natalie works with teachers to support them in the implementation of a new curriculum, lesson study, planning, and embedding of routines.

about Elizabeth Phillips

Concurrents II & VI Arc of Learning framework: developing conceptual understanding (co-speaking with Yvonne Grant)

Elizabeth Phillips My on-going interests are in the teaching and learning of mathematics with a special interest in teaching and learning algebra. In addition to authoring numerous papers and books, I am a co-author of National Science Foundation (NSF)-funded The Connected Mathematics Project (CMP 1 and CMP2). Since the revision of CMP3 in 2014, we have taken on several research projects related to CMP.

(1) The Student Work in Curriculum Materials Research Project: The potential benefits of student work as a context for student learning are largely unknown because most research related to student work has examined effects of student work for enhancing teachers' mathematical knowledge for teaching. The purpose of this project is to explore the use of student work found in curriculum materials and its potential for improving the teaching-learning environment.

(2) The Arc of Learning Research Project: The Arc of Learning framework was designed to describe the development of mathematics understanding provided by a sequence of problems. This framework moves the learning focus beyond the analysis of isolated tasks to consider the role of a problem and its location in an instructional sequence for promoting mathematical learning.

(3) Formative Assessment Research Project: Throughout a CMP lesson, teachers engage in three components of formative assessment, supported by current research and best practices in mathematics education. To address concerns about how to assess student learning during the enactment process, we have developed a framework and a set of resources to help mathematics teachers and instructional leaders make sense of formative assessment as an ongoing process in CMP lessons.



(4) Enhancing Students' Capacity to Develop and Communicate Their Understanding Using Digital Inscriptional Resources: Using the Connected Mathematics Project materials, the combined efforts of MSU and Concord Consortium aim to create a collaborative, digital environment to research students' ability to communicate mathematical understanding. A major goal of project is to help students deepen and make visible their understanding of mathematics. We propose to support students to collaboratively construct, manipulate, and interpret shared representations of mathematics using digital inscriptional resources. This is an NSF-funded project.

about Susan Jo Russell

Concurrent VII Focusing on equity while engaging elementary students in mathematical practices

Concurrents V & VI Mathematical argument in the elementary classroom: a model for teachers and coaches (co-speaking with Deborah Shifter)

Susan Jo Russell began her career in education as an elementary classroom teacher. She is currently at the Education Research Collaborative at TERC, where she has directed research and development projects in mathematics education for over 30 years. She co-directed the development and revision of the NSF-funded elementary curriculum, *Investigations in Number, Data and Space* and the professional development materials, *Developing Mathematical Ideas*. Her current work focuses on understanding how practicing teachers can learn more about mathematics and about children's mathematical thinking and on how young students articulate, represent, and justify general claims in the context of ideas that arise naturally from their study of number and operations. In particular, she is interested in how students with a history of poor achievement in grade-level computation and students with a history of excelling in grade-level computation engage in these ideas. She is co-author, with Deborah Schifter and Virginia Bastable, of a book for teachers in grades 1-6 (with accompanying study guide for teacher educators) about these ideas, *Connecting Arithmetic and Algebra*, and of forthcoming text and video materials, with Schifter, Bastable, Traci Higgins, and Reva Kasman, *But Why Does It Work?: Mathematical Argument in the Elementary Classroom*.

about Deborah Schifter

Concurrent I Early algebra and MP7: a focus on the operations

Concurrents V & VI Mathematical argument in the elementary classroom: a model for teachers and coaches (co-speaking with Deborah Schifter)

Deborah Schifter is a principal research scientist at the Education Development Center, Waltham, MA. She has worked as an applied mathematician; has taught elementary, secondary, and college level mathematics; and, since 1985, has been a mathematics teacher educator and educational researcher. She authored *Reconstructing Mathematics Education: Stories of Teachers Meeting the Challenge of Reform* and edited a two-volume anthology of teachers' writing, *What's Happening in Math Class?* She was a writer for *The Mathematical Education of Teachers* as well as the second and third editions of the K-5 curriculum, *Investigations in Number, Data, and Space*. With Virginia Bastable and Susan Jo Russell, she produced the professional development series, *Developing Mathematical Ideas*, and *Connecting Arithmetic to Algebra*, a book which is used as the basis for an on-line course for teachers of grades 1 to 6.



In recent years, Dr. Schifter has been working with Russell and Bastable to investigate algebraic thinking at the elementary level. Specifically, they have been studying students' ability to notice, articulate, prove, and apply generalizations about the behavior of the operations. They have developed sequences of lessons for grades 2 to 5 that focus on this content and examine what teachers must learn—in terms of mathematics content and pedagogical moves—to make such lessons effective. Their book titled, *But Why Does it Work? Mathematical Argument in the Elementary Grades*, will be published by Heinemann in 2017.

Dr. Schifter is also currently working with Virginia Bastable on revisions of the *Developing Mathematical Ideas* professional development series which is now published by NCTM.

about Nanette Seago

Concurrents III & V How does video-based professional development influence teacher practice? (co-speaking with Karen Koellner)

Nanette Seago currently serves as principal investigator (PI) for the DRK-12 NSF funded project, Learning and Teaching Geometry: Videocases for Mathematics Professional Development project. Additionally, she serves as Co-PI for an IES project: Linear Functions for Teaching: An Efficacy Study of Learning and Teaching Linear Functions. From 2003-2009 she served as Co-PI for two other NSF projects, a ROLE project: Turning to the Evidence: What Teachers Learn by Using Classroom Records and Artifacts in Mathematics Instruction and a teacher enhancement project: Developing Facilitators of Practice-Based Professional Development. From 1998-2004, Nanette served as the Co-PI for the NSF Video Cases for Mathematics Professional Development Project.

In 2002, Nanette collaborated with LessonLab in the development of the TIMSS-R public release videos and the design of an online course sponsored by Intel Corporation entitled: TIMSS Video Studies: Explorations of Algebra Teaching. She has published three books: *Learning and Teaching Linear Functions: Video Cases for Mathematics Professional Development*, *Learning and Teaching Geometry: Video Cases for Mathematics Professional Development*, and *Examining Mathematics Practice through Classroom Artifacts*. In addition, since 2003, Nanette has presented at numerous national and international conferences, and published numerous peer-reviewed scientific journal articles and international book chapters around the research and development of video-based professional development.



about Mike Shaughnessy

Concurrents II & VI The Math Habits & Routines Classroom Observation Tool: connecting teacher moves and student reasoning (co-speaking with Kate Melhuish, Julie Fredericks, & Eva Thanheiser)

J Michael Shaughnessy first became interested in mathematics during his high school years in upstate New York, majored in mathematics at LeMoyne College in Syracuse, NY, and completed his PhD in mathematics and mathematics education at Michigan State University. Mike served on the faculty of the Mathematics Department at Oregon State University from 1976 - 1993 and continued his work in mathematics education in the Department of Mathematics and Statistics at Portland State University from 1993 to 2008.

Mike was a member of the Board of Directors of the National Council of Teachers of Mathematics (NCTM) from 2001 – 2004, and served as President of NCTM from 2009 - 2013.

Mike has taught mathematics and statistics content courses and directed research grants and professional development for mathematics teachers at all levels, K–12, community college, and university. Throughout his career his principal research interests have been in the teaching and learning of statistics and probability and the teaching and learning of geometry. In recent years he has been working on research and development projects on improving the teaching of mathematics. He is currently co-principal investigator for the NSF funded DRK-12 project, Enhancing Mathematics Teaching and Learning in Urban Elementary Schools.

about Virginia Stimpson

Concurrents I-II What helps students develop a meaning-based, visceral feel for operations with integers?

Dr. Virginia C. Stimpson (Gini) is a nationally recognized mathematics educator who has served as a co-principal investigator on NSF-funded and Eisenhower-funded professional development and research-focused grants during and following her 35 years as a high school math and physics teacher. From 2004-2007 she was the evaluator on the NSF-funded project, Lenses on Learning: Understanding Mathematics Instruction at the Secondary Level. She also served as the evaluator of the NSF project, Facilitating Lenses on Learning: Developing Leadership to Support Excellent Teaching in Elementary Mathematics. She was a member of the Advisory Board for the development of the DMI seminars that focus on algebra and has facilitated DMI seminars and prepared more than 400 teacher leaders to use those materials with their colleagues through both the University of Washington and Mount Holyoke College. Gini also served for seven years (2008-2015) as a member of the TDG Board of Directors.

Gini currently facilitates TDG Math Studios in both elementary and secondary mathematics classrooms. During Math Studio "Data Snap" walk-throughs, she has noticed students often make references to operations on integers that suggest that they have memorized procedures and facts rather than made sense and/or developed a visceral feel for the nature of the answer. This has led to considering how visual and context-based experiences can help students develop meanings with connections and deep knowing about integers, and this informs the session that will be offered at this 2017 TDG Leadership Seminar.



about Eva Thanheiser

Concurrents II & VI The Math Habits & Routines Classroom Observation Tool: connecting teacher moves and student reasoning (co-speaking with Kate Melhuish, Julie Fredericks, & Mike Shaughnessy)

Dr. Eva Thanheiser is an Associate Professor in the Fariborz Maseeh Department of Mathematics and Statistics at Portland State University and Faculty in Residence for Pedagogy at Portland State University. At Portland State University Eva teaches content courses for elementary and middle-school teachers as well as courses for PhD students in mathematics education.

Eva's research has focused on several avenues. Avenue 1: Examining teacher knowledge, the development of that knowledge, and teacher motivation to learn. Avenue 2: Understanding how teachers think about equity and social justice in the context of teaching mathematics and how contexts of equity and social justice can be used to teach mathematical content. Avenue 3: In collaboration with Teachers Development Group (and funded by an NSF DRK12 grant) examining in-service teacher professional development experiences. With this project, Enhancing Mathematics Teaching and Learning in Urban Elementary Schools, we research the efficacy of the Math Studio model of professional development implemented in a large urban school district.

about Peter Thorlichen

Concurrents I & VII Supporting more equitable teaching practices during math instruction (co-speaking with Linda Ruiz Davenport & Connie Henry)

Peter Thorlichen is Assistant Director of K-12 Mathematics for the Boston Public Schools. He is in his fourteenth year in Boston, and has worked as a math coach and math content specialist in individual schools and district-wide. In these roles, Peter has developed and provided various types of professional development for teachers, teacher leaders, and administrators. This has included facilitating DMI seminars, collaborative coaching and learning sessions, math labs, content institutes, and sessions designed to support the leadership work of math teacher leaders in Boston schools. Peter co-presented at TDG in 2012 - a plenary session entitled, Creating Shared Visions of Elementary Mathematics Teaching and Learning Using the CCSS as a Context for Collaboration within a District. He is happy to be returning to TDG this year.



about Laura Van Zoest

Plenary C Building on MOSTs

Laura Van Zoest is professor of mathematics education at Western Michigan University. She has served as the principal investigator for research and professional development projects funded at over two million dollars. She has published in both research and practitioner journals, including the *Journal of Mathematics Teacher Education*, *Mathematics Teacher Educator* and the *Mathematics Teacher*. She was editor of *Teachers Engaged in Research: Inquiry into Mathematics Practice, 9-12*, guest coeditor of the *ZDM: The International Journal on Mathematics Education* focus issue, *Theoretical Frameworks in Research on and with Mathematics Teachers*, and coeditor of *Research Trends in Mathematics Teacher Education*.

Laura specializes in secondary mathematics teacher education, focusing specifically on the process of becoming an effective mathematics teacher and ways university coursework and professional development can accelerate that process. Her research and teacher development practice are intertwined and have included investigating the effect of reform curriculum materials on teacher development, the use of practice-based materials in university methods courses, and the cultivation of productive norms in teacher education. Her current work with colleagues Shari Stockero, Keith Leatham, and Blake Peterson involves developing a theory of productive use of student thinking in order to support teachers in capitalizing on opportunities to build on that thinking to develop students' mathematical understanding.

about Anthony Muro Villa III

Concurrents V & VII Preparing teacher leaders to facilitate video-based discussions in mathematics professional development (co-speaking with Hilda Borko)

Anthony Muro Villa III is a doctoral student in the Curriculum and Teacher Education program with an emphasis in mathematics education at the Stanford Graduate School of Education. He currently studies the ways students interact in small groups around a mathematics task, with special attention to the peer-to-peer probes that contribute to elements of mathematical argumentation. Anthony works as a research assistant with Dr. Hilda Borko and Dr. Janet Carlson on their current NSF-funded project, *Refining a Model with Tools to Develop Mathematics Professional Development Leaders: An Implementation Study*. Anthony is an instructor in the Stanford Teacher Education Program, teaching courses on curriculum and instruction in mathematics, equity and schooling, and secondary credentialing for mathematics instruction. Prior to Stanford, Anthony facilitated Write Path workshops, a literacy professional development through the Achievement Via Individual Determination (AVID), a college readiness program. Along with participating in AVID, he taught secondary mathematics for eleven years, teaching courses from algebra to AP Calculus BC.



about Molly Williams

Concurrents III & IV Capitalizing on the visibility of practice within math studio to understand teachers and coaches as learners (co-speaking with Ruth Heaton & Michelle Metzger)

Dr. Molly Williams is currently a postdoctoral research assistant at the University of Nebraska-Lincoln. She started her trajectory into math education by studying mathematics and receiving a bachelor's degree at Murray State University. While continuing her studies of mathematics at the University of Nebraska-Lincoln, she became involved in reforming undergraduate courses in the Department of Mathematics. After receiving her masters in mathematics, she switched to being a graduate student within the Department of Teaching, Learning, and Teacher Education to pursue a doctorate under the guidance of Dr. Ruth Heaton. During her time as a doctoral student, Molly was involved in teaching both mathematics and pedagogy courses to preservice and inservice elementary teachers as well as teaching mathematics to non-education major undergraduate students. She has worked closely with Dr. Heaton on many different projects, but has been consistently involved in planning, facilitating, and studying a version of Math Studio with teachers, math coaches, and administrators. Her research interests include exploring the effects of active learning on teachers and students in K-16 as well as the kinds of professional development needed to support the teaching and learning involved with active learning.





about the **OPENING KEYNOTE**

OPENING KEYNOTE (Wednesday 6:45 pm)

AMANDA (MANDY) JANSEN K-12

Creating a motivating and engaging mathematics classroom climate

This session will engage teachers and teacher leaders in reflecting upon elements in a mathematics classroom climate that can engage and motivate students. Five components of a motivating classroom climate, supported by research literature, will be presented to raise awareness of those in attendance about what teachers can do to motivate students. Together, we will consider what these components look like: a climate of understanding, of curiosity and relevance, of support for challenge, of active learning and agency, and of a welcoming and warm classroom community.

We will also think together about how to enact these elements of a motivating and engaging classroom climate, including how to invite students to participate more fully. To that end, we will consider the “rights of the learner” that support accessing fuller engagement with mathematics learning. Four possible “rights of the learner” will be shared, and we will brainstorm how they support students’ learning as well as any additional rights that we should advocate for our students to have in the mathematics classroom.





about the **PLENARY SESSIONS**

PLENARY A (Thursday 1:30 pm)

KRISTEN BIEDA K-12

Engaging students in justification is equity

Justification is not only a central practice for doing mathematics, but it is also a powerful tool for helping all students build agency and access to mathematics through classroom work. This session will focus on discussing key aspects of the practice of justifying as it relates to the Common Core State Standard for Mathematical Practice (SMP 3 - Generating Arguments and Critiquing the Reasoning of Others) and critically examining examples of the SMP 3 from middle school classrooms. We will use Gutiérrez's (2002) notions of access and agency to consider the potential of tasks and teacher moves related to the practice of justifying for supporting students' access and agency in mathematics classrooms.

This session will be of particular interest to teacher leaders, teacher professional developers, and administrators particularly interested in working toward goals for equitable outcomes for all students and changing the nature of mathematics classroom culture in their schools. Participants will receive a toolkit for work toward implementing justification-focused instruction in classrooms, as well as discuss ways to modify and adapt curriculum to heighten opportunities all students have for engaging in justification.

PLENARY B (Friday 1:30 pm)

ELHAM KAZEMI & KENDRA LOMAX K-12

Leading productive mathematical discussions

When teachers fall in love with children's thinking, they learn the importance of asking students, "How did you do that? Tell me how you solved that problem?" Sharing strategies is a natural starting point for mathematical discussions. But, it can also be challenging for teachers to know what to do with the ideas they hear and how to orchestrate discussions so they are a meaningful experience for students. Does every discussion need to include sharing lots of different strategies? In this session, we take on that question and consider different kinds of discussions that teachers can facilitate, each of which has a different goal. Different goals mean that not every discussion needs to be about sharing a broad range of strategies. Using videos of discussions and transcripts of classroom episodes, we will examine how specific goals can provide the teacher with choices about how to focus mathematical discussions intentionally for students.

PLENARY C (Saturday 10:30 am)

LAURA VAN ZOEST K-12

Building on MOSTs

The mathematics education community recognizes the important role student mathematical thinking plays in teachers' crafting and enacting quality mathematics instruction (e.g., NCTM, 2014). The field has begun to understand how to effectively use written records of student work to support mathematics learning (e.g., Smith & Stein, 2011), but much less is known about how to effectively use in-the-moment student thinking that emerges during whole-class discourse—thinking that can provide valuable opportunities to improve student understanding of important mathematics. The MOST Research Group has argued that the most productive use of high-leverage student mathematical thinking that emerges in-the-moment during whole-class discussion (MOSTs) is for the teacher to make that thinking the object of consideration by the class in order to engage the class in making sense of that thinking to better understand an important mathematical idea—what we call the teaching practice of building on student thinking. Such use encapsulates the core ideas of current thinking about effective teaching and learning of mathematics as put forth in *Principles to Actions* (NCTM, 2014).

In the closing plenary, I will draw on the work of the Leveraging MOSTs research group to discuss what we have learned about MOSTs, teacher responses to student mathematical thinking, and the teaching practice of building. Along the way, I will make connections to the ideas introduced in earlier sessions.





about the **CONCURRENT SESSIONS**

about **Concurrent Sessions I** (Thursday 8 am - 10 am)

HAROLD ASTURIAS K-12

Maker Projects: activating students' agency, authority, and identity

How can we activate students' interest and curious minds in ways that ignite persistent engagement in science, technology, engineering, art, and mathematics learning, inquiry, and innovation? How do Maker Projects and lesson study promote a deeper understanding of the role that students' mathematical agency, authority, and identity (AAI) play in the classroom? Learn how we've been working with K-8 teachers to create powerful mathematics classrooms where students develop robust understanding of the concepts they are learning and the academic language to communicate their reasoning.

LINDA RUIZ DAVENPORT, CONNIE HENRY & PETER THORLICHEN K-12

Supporting more equitable teaching practices during math instruction

Our session focuses on a collaboration with the district's K-12 math teacher leaders designed to promote more equitable teaching practices during math instruction across the district. These K-12 math teacher leaders, representing elementary, middle, and high schools grade bands across the district, are selected by application and meet with us for 3 full-day sessions and 3 after-school sessions during the school year.

These K-12 math teacher leaders are expected to use what they are learning in our sessions to strengthen their own practice and engage their school colleagues and administrators in the work, as well, using a variety of school structures including Instructional Leadership Teams (ILTs), Math Leadership Teams (MLTs), common planning time (CPTs), and secondary math department meetings.

Our math teacher leadership work this year draws on the *Mathematics Education Through the Lens of Social Justice: Acknowledgment, Actions, and Accountability* document from NCSM and TODOS and addresses the following goals: increasing the use of participation structures that maximize student contributions while minimizing status issues in the classroom; cultivating and sustaining a positive mathematics identity and affect; focusing on mathematical strengths and areas of growth with targeted meaningful feedback; and adapting instruction that routinely connects children's mathematical thinking to students' funds of knowledge. These goals build on work with our K-12 math teacher leaders in previous years addressing CCSSM content and practice standards, formative assessment strategies and, last year, the math teaching practices in NCTM's Principles to Actions.

In our session, you will engage in a selection of activities from our first three teacher leadership sessions this year; discuss challenges and opportunities associated with these activities, and reflect on connections to your own role and context. We will also share our vision for the rest of the school year and for subsequent years.

MIKE FLYNN K-8

Unlocking the power of problem-based learning: supporting teachers in creating and implementing rich tasks

Problem-based learning is a powerful learner-centered approach in which students learn mathematical concepts by working through an open-ended or open middle task. Rather than providing direct instruction on a particular method that students should use and then having students solve the problem with that method, problem-based learning involves starting with the problem first and having students develop their own solution pathways. Problem-based learning tasks require students to define the question, find the relevant information necessary to solve the problem, decide which tools are needed, evaluate possible approaches, solve the problem, share their findings, and compare their reasoning to others. This session will draw upon Mike's recent work on task development and implementation with K-8 students as well as adult learners.

During this session, participants will engage in a variety of problem-based learning activities including 3-act math tasks, open-middle problems, and open-ended tasks. We will explore how these tasks can be used to support



about Concurrent Sessions I (con't)

student learning and for staff development. Participants will learn protocols for creating rich tasks, explore rubrics for task analysis, and learn effective instructional strategies when implementing a problem-based learning approach. Participants will leave with a variety of resources to support teachers, including links to hundreds of tasks, planning guides, templates, articles, and access to an online repository of problem-based learning resources.

GRACE KELEMANIK & AMY LUCENTA K-12

Using routine rehearsals to transform teaching practices

Teaching students to think and reason mathematically requires additional teaching practices. Helping teachers expand their repertoire of instructional moves means expanding our professional learning practices to include lesson rehearsal. Providing teachers regular opportunities to try, rethink, and retry new teaching moves in-the-moment builds new teaching muscles. Because instructional routines are designed to be repeated, they are the perfect rehearsal vehicles for developing new teaching practices.

Rehearsals are a staple of learning in many fields. Doctors practice on cadavers. Pilots spend countless hours in flight simulators. And now, teacher candidates are rehearsing lessons in practice-based preservice programs. Kazemi, Kelley-Peterson and Lampert's research upholds the effectiveness of rehearsals in teacher development. As practicing teachers are now working to develop the eight NCTM Mathematical Teaching Practices, rehearsals are making their way into professional development and professional learning communities.

This session leverages best practices from the preservice field to help professional development and coaches (and colleagues!) support teacher development through rehearsals. During the session participants will learn about a set of powerful rehearsal strategies. They will experience a rehearsal and reflect on the strategies used and their impact on teacher practice. Participant will also have an opportunity to apply the session ideas to their own work with teachers and the math teaching practices they are targeting in their work.

DEBORAH SCHIFTER K-6

Early algebra and MP7: a focus on the operations

Although the heart of K-6 mathematics focuses on calculating with the four basic operations, the meaning of the operations and the differences among them may fall into the background. Indeed, many common calculation errors, as well as many common errors in algebra, stem from confusion about which structures apply to which operation.

This session will present examples from classrooms to illustrate how work within two branches of early algebra—functions and generalized arithmetic—can provide a context for highlighting the operations as distinct objects. The examples emphasize two major themes: The role of representations in the study of structure and teachers' actions that draw students' attention to those structures.



about Concurrent Sessions I - I I (Double Sessions, Thursday 8:00 - 12:15)

LINDA LEVI K-6

Teaching base ten with understanding: a Cognitively Guided Instruction (CGI) approach

In Cognitively Guided Instruction (CGI) professional development, we support teachers' understanding of base ten number concepts through a focus on children's thinking. We work with teachers to understand a framework for problem types that engage children with base ten number concepts. These problem types are the same for base ten units greater than one (tens, hundreds, thousands and so on) as well as base ten units less than one (tenths, hundredths, thousandths and so on). We also examine the strategies that students use to solve these problems and analyze the base ten concepts embedded in each strategy. Through a focus on children's thinking, we support teachers to deepen their own understanding of the base ten number system. Teachers increase their knowledge of mathematics in conjunction with their knowledge of children's thinking.

In this session, we will discuss the CGI framework of problem types that engage children with base ten number concepts. We will view video of children solving these problems and assess their understanding of specific base ten number concepts. The video examples will include children solving problems with base ten units greater than one as well as base ten units less than one. A framework for helping teachers understand base ten number concepts will be shared. Activities to support teachers to understand the problem types; students' strategies for solving problem and base ten number concepts will also be discussed. Participants will have the opportunity to design problems to address base ten number concepts related to their standards. Participants will discuss how the problems they write could be integrated with their curriculum materials.

VIRGINIA (GINI) STIMPSON 5-12

What helps students develop a meaning-based, visceral feel for operations with integers?

While doing "Data Snap" walk throughs in classrooms, we often notice students making references to operations on integers that suggest they have memorized procedures and facts rather than made sense and/or developed a visceral feel for the nature of their answers. Students say such things as "I know these two negative numbers will add to a positive because two negatives make a positive." Hearing student comments such as this has led me to consider what visual and context-based experiences develop "meanings with connections" and deep knowing about integers.

My plan is for participants to: (1) engage in several experiences that have the potential to build meaning for multiplying and subtracting integers, (2) explore the ways, if any, they give us a visceral sense of the size and sign of the answer; and (3) add to those experiences based on participants' suggestions and/or other lessons that I have witnessed. I also want to explore ways that students might respond when they justify their answers involving work with integers based on their earlier meaning-making experiences.

There are several things that I draw on for this work. Among them are work with the DMI curricula, particularly *Making Meaning of Operations* and *Reasoning Algebraically with Operations*. I also have the benefit of seeing classroom lessons that support students in justifying and generalizing about their work with integers and hearing students justify answers based on their earlier meaning-making rather than referring to an anchor chart or digging through their memory for rules with no justification.





about Concurrent Sessions II (Thursday 10:15 am - 12:15 pm)

VIRGINIA BASTABLE K-9

Changing the domain from whole to rational: expanding mathematical knowledge in the context of division. How is working on such ideas with adult learners similar to and different from working with elementary-aged students?

Participants in this session will:

- Explore meanings of division and how they are exemplified through story contexts.
- Consider what modifications are needed to when the divisor is larger than the dividend.
- Examine the connections across story situation, equations and visual representations.
- Analyze a case of adult learners working on this math
- Discuss the implications of this work for the teachers with whom they work.

CCSSM states that students apply and extend previous understandings of whole numbers to work with rational numbers. However, few math educators have had the opportunity to learn mathematics as a coherent set of ideas that is modified as the number domains change from whole to rational. This session will provide opportunities for participants to expand their own mathematical knowledge through small group discussion, sharing of ideas, and collaborating with others. The session will also include analysis of a case examining adult learners working on this mathematical idea to support discussion of how working on mathematical ideas is the same and different when the audience is adults or students.

GRACE KELEMANIK & AMY LUCENTA K-12

Using routine rehearsals to transform teaching practices

Teaching students to think and reason mathematically requires additional teaching practices. Helping teachers expand their repertoire of instructional moves means expanding our professional learning practices to include lesson rehearsal. Providing teachers regular opportunities to try, rethink, and retry new teaching moves in-the-moment builds new teaching muscles. Because instructional routines are designed to be repeated, they are the perfect rehearsal vehicles for developing new teaching practices.

Rehearsals are a staple of learning in many fields. Doctors practice on cadavers. Pilots spend countless hours in flight simulators. And now, teacher candidates are rehearsing lessons in practice-based preservice programs. Kazemi, Kelley-Peterson and Lampert's research upholds the effectiveness of rehearsals in teacher development. As practicing teachers are now working to develop the eight NCTM Mathematical Teaching Practices, rehearsals are making their way into professional development and professional learning communities.

This session leverages best practices from the preservice field to help professional development and coaches (and colleagues!) support teacher development through rehearsals. During the session participants will learn about a set of powerful rehearsal strategies. They will experience a rehearsal and reflect on the strategies used and their impact on teacher practice. Participant will also have an opportunity to apply the session ideas to their own work with teachers and the math teaching practices they are targeting in their work.

KENDRA LOMAX & ELHAM KAZEMI

Mathematical modeling in the primary grades with three-act tasks K-6

Children need opportunities to identify mathematical problems in their world, determine what information will help them solve a problem, develop mathematical models of situations, and revise their models to more closely predict real world phenomena. This is the work of modeling with mathematics identified in the Common Core Standards as one of the practices of doing mathematics.

Three-Act Tasks are lesson structures designed specifically to engage children in modeling with mathematics. The activity was created by Dan Meyer for high school mathematics. We have learned from teachers around the country who have been developing and trying these tasks with elementary-aged children. In this session, we will engage participants in several Three-Act Tasks in order to learn about their structure and what kind of mathematics children might work on. We will study video examples of Three-Act Tasks in action in primary grades. Participants will have an opportunity to select a task they want to try in their own context.

Examples in this session draw from grades K-2, but have relevance across the elementary grades.



about Concurrent Sessions II (con't)

ELIZABETH PHILLIPS & YVONNE GRANT 5-10

Arc of Learning framework: developing conceptual understanding

Learning progressions show how students' prior knowledge and experiences build over time from informal knowledge into more sophisticated reasoning (Clements & Sarama, 2004; Sztajn, Confrey, Wilson, & Edgington, 2012). Learning progressions involve purposeful sequences of problems that provide students opportunities to build and articulate connections among ideas and to develop a view of mathematics as a coherent and connected discipline (Fosnot & Jacobs, 2010). In problem-centered curriculum materials, problems refer to contextual task situations that support some or all of the following (Lappan & Phillips, 2009): (a) has important, useful mathematics embedded in it, (b) promotes conceptual and procedural knowledge, (c) builds on and connects to other important mathematical ideas, (d) requires higher-level thinking, reasoning, and problem solving (e.g., mathematical practices), (e) provides multiple access points for students, (f) engages students and promotes classroom discourse, and (g) creates an opportunity for teachers to access student learning (e.g., formative assessment).

The Arc of Learning framework (Phillips et al, 2014) describes student development of mathematical understandings for key concepts and methods. This framework moves the learning focus beyond the analysis of isolated tasks to consider the role of a problem and its location in a connected sequence of problems for promoting conceptual understanding of mathematics. To make explicit the learning progressions of a problem-centered curriculum, the Arc of Learning framework consists of five phases that describe a learning process for students as they explore mathematics problems over time (Edson et al, 2015). The five phases are Introducing (Setting the Scene), Exploring (Mucking About), Analyzing (Going Deeper), Synthesizing (Looking Across, and Abstracting (Going Beyond.) The processes of connecting, reflecting, assessing, and mathematical practices span across the five phases.

The goal of the session is to use the Arc of Learning to examine how middle grades students' mathematical learning develops over time. The unit on linear functions, Moving Straight Ahead, from the algebra strand and Let's Be Rational from the number strand in the Connected Mathematics curriculum will be used to guide the exploration and discussions. By the end of the session, participants will have had opportunities to:

- Discuss the Arc of Learning, its five phases, and its underlying research base on how students mathematical learning is developed;
- Engage in a hands-on activity designed around constructing sequences of mathematics problems, their mathematical goals, and potential student thinking resulting from the problem-solving tasks;
- Report out and reflect on the outcomes of the analyses, including points of agreement and disagreement as well as unit specific frameworks; and
- Discuss implications and recommendations for how research and practice activities can be informed by the Arc of Learning.

Clements, D. H., & Sarama, J. (2004). *Learning trajectories in mathematics education. Mathematical Thinking and Learning*, 6(2), 81-89.

Edson, A.J., Gilbertson, N.J., Gonulates, F., Grant, Y., Nimitz, J.L., Phillips, E., & Satyam, V.R. (2015). *Studying the arc of learning in middle school mathematics curriculum materials. In T.G. Bartell, K.N. Bieda, R.T. Putnam, K. Bradfield, & H. Dominguez (Eds.) Proceedings of the 37th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education (pp. 104-107). East Lansing, MI: Michigan State University.*

Fosnot, C.T., & Jacobs, W. (2010). *Young mathematicians at work: Constructing algebra. Portsmouth, NH: Heinemann.*

Lappan, G., & Phillips, E. (2009). *A designer speaks: Challenges in US mathematics education through a curriculum developer's lens. Educational Designer*, 2(1).

Phillips, E., Gilbertson, N., Grant, Y., & Stewart, J. (2014, April). *New standards and classic problems: the case of CMP. Paper presented at the annual National Council of Supervisors of Mathematics conference, New Orleans, Louisiana.*

Sztajn, P., Confrey, J., Wilson, P.H., & Edgington, C. (2012). *Learning trajectory based instruction: Toward a theory of teaching. Educational Researcher*, 41(5), 147-156.



about Concurrent Sessions II (con't)

MIKE SHAUGHNESSY, KATE MELHUISH, EVA THANHEISER & JULIE FREDERICKS K-12

The Math Habits & Routines Classroom Observation Tool: connecting teacher moves and student reasoning

Measuring the degree of teacher implementation of critical components of professional development is often cited as the essential link when evaluating the effectiveness and efficacy of professional development programs (O'Donnell, 2008). As part of a large-scale efficacy study supported by the National Science Foundation, we have developed a tablet-based classroom observation tool to measure the implementation level of teacher participants and their students. As with other tools (e.g., Boston, Bostic, Lesseig, & Sherman, 2015), we also use this tool to support mathematics teachers and leaders in their professional learning.

The *Math Habits and Routines Classroom Observation Tool* is a tablet application that aims to capture: (1) the type of reasoning and discourse that students engage in, and (2) what teachers are doing to catalyze student reasoning and discourse. The power of this tool lies in the ability to make connect students' mathematical engagement and the teacher's use of teaching habits and routines. The tool (still in pilot stage) is rooted in research on effective teaching, learning, and professional development and was developed in an effort to capture classroom implementation of research-based best practices (e.g. Smith, & Hughes, 2008) and high-level student reasoning (e.g. Henningsen & Stein, 1997).

In this session, we will view some video clips from a lesson as a context for introducing the *Math Habits and Routines* tablet application and we will discuss ways to use the application as both a research tool and as a learning/reflection tool that supports teachers and leaders in refining their practices. Tablets will be provided for groups of participants to share.





about Concurrent Sessions III (Thursday 3:15 pm - 5:15 pm)

DIANE BRIARS K-9

Strategies and tasks to build procedural fluency from conceptual understanding

Procedural fluency—skill in executing arithmetic and algebraic procedures flexibly, accurately, efficiently, and appropriately—is an important outcome for all students. The most effective way to develop such fluency is for students to connect procedures to the underlying concepts. At the same time, building procedural fluency from conceptual understanding is a challenge for many teachers. This session addresses the questions: *What is procedural fluency? What tasks and strategies help students build fluency from conceptual understanding? What common pitfalls should I avoid? How can leaders support teachers in building students procedural fluency? What resources are available to support this work?*

ANURUPA GANGULY 6-12

Developing ‘Function Sense’ for teachers and students through the art of conjecturing

The eight mathematical practice standards outlined by the CCSS-M seek to engage our K-12 students in the processes and patterns of thinking required for the making and growing of mathematics. Though the making and exploration of conjectures is an essential component of these practices, it often remains underrepresented in our secondary mathematics curriculum. Inviting conjectures, which often build from apparent inconsistencies or seemingly unintuitive premises, not only afford our students of school mathematics the opportunity to invent, create and explore mathematical statements and constructs, it also supports the belief that mathematics is not a closed canon but one that continuously grows in theory and application.

In this session, participants will explore ways to pose questions that lead teachers and students to make authentic conjectures - specifically about the behaviors of various function types and their underlying structure. We begin with the Functions domain because Functions serve as an important mathematical object in the middle and high grades. More often than not we employ narrow questioning patterns that encourage students to memorize certain attributes of a function type and apply that set to similar problem types. Instead, we should aim to ensure that students reach a level of fluency, ease and comfort with Functions and their manipulations and transformations in a variety of situations, which we coin as Function Sense (a parallel to Number Sense in the elementary grades).

In addition to examining the questioning patterns that encourage authentic conjectures, we will employ open source online platforms that provide space to explore new graphical representations of functions in an effort to test and confirm our conjectures. This initial toolkit of strategies and resources will springboard a greater conversation around ways to routinize the important skill of Function Sense, as well bring in the art of conjecturing in other domains of mathematics teaching and learning. If possible, please bring a laptop to the session, as some of the activities will require participants to use the online platforms.

LYNSEY GIBBONS K-8

Using Number Talks to support student and teacher learning across a system

In this session, we will explore our efforts to support teachers to take up Number Talks across schools within our district. Number Talks are five- to fifteen-minute conversations around purposefully crafted problems during which students are asked to communicate their thinking when presenting and justifying solutions to problems they solve mentally. These exchanges can lead to students' development of more accurate, efficient, and flexible strategies. Number talks can also be an important tool for teachers' development. In this session, we explore our efforts to support teachers' learning about and use of Number Talks. We describe our journey to support Number Talks to be used routinely in classrooms across our school district, but were only moderately successful. When we began using a full day professional learning structure (called Math Labs) across some of our schools, our teachers were able to work together on planning and implementing Number Talks. These learning opportunities helped them to feel comfortable using Number Talks regularly in their classrooms. During the session, we will explore what Number Talks are, as well as the professional learning design that supported our teachers' learning and development.



about Concurrent Sessions III (con't)

RUTH HEATON, MICHELLE METZGER & MOLLY WILLIAMS K-5

Capitalizing on the visibility of practice within Math Studio to understand teachers and coaches as learners

Since 2011, Heaton has been leading versions of Math Studio in elementary schools in one urban and one suburban school district in Nebraska building off the Math Studio model of Teachers Development Group. Nebraska's Math Studio model was originally focused as a learning opportunity for classroom teachers. However, over time, the participants and the goals of Math Studio were redesigned to meet the needs of varied participants (Carlson, Williams, & Heaton, accepted).

Our first redesign expanded participants of Math Studio from only teachers to include math coaches as well as school and district administrators. The focus was on deepening everyone's understanding of math teaching (e.g. NCTM 2014) and learning practice (e.g. Cuoco, Goldenberg, & Mark, 1996; CCSS Initiative, 2010) While the participants remained the same, over time, we began to individualize learning goals for the varied participants. We began each Math Studio with distinct learning goals about improving teaching for teachers, improving methods of supporting teachers for coaches, and expanding and strengthening the math leadership voice of the administrator to one of helping teachers reflect on their own math teaching practices and evaluating math instruction in ways that align with current reforms. Our latest iteration involves a Math Studio attentive to the improvement of math teaching practices within a Math Studio focused on the improvement of coaching practices (Barlow, Burroughs, Harmon, Sutton, & Yopp, 2014).

Visibility of dilemmas and decisions that undergird coaching, teaching, and learning practices is a common feature across all Math Studios, given the public nature of practice that characterizes Math Studio, no matter who the specific participants nor what the specific goals are. Based on what teachers and coaches notice (Van Es & Sherin, 2002) and how we see and hear them respond to one another or the facilitator within Math Studio, we can begin to make some conjectures about who they are as learners. We can begin to identify strengths and limitations in their understandings of math, pedagogy, and their learners, and we can begin to surmise what they have yet to learn. Just as the ongoing analysis of students' understanding is essential to target future instruction and improve mathematical understanding (e.g. Clements & Sarama, 2004; Wilson, Mojica & Confrey, 2013), so too is the need to analyze the learning of teachers as well as math coaches, formatively assess learning, and plan future goals for professional development opportunities.

In this session, we will share our preliminary understanding of the variance that exists among teachers as learners and coaches as learners based upon the data we have gathered in the context of Math Studio. In the session, participants will first examine excerpts from our data drawn from planning, teaching and debriefing sessions from our teaching and coaching Math Studios. Specifically, we will share contrasting collections of data excerpts from a small subset of the 18 Math Studio teachers and 16 math coaches with whom we have worked. We will facilitate small and large group discussion among session participants about the common and disparate characteristics of teachers and coaches as learners based on our data. We will also give session participants opportunities to link our experiences, as represented by data, with their own in an effort to discuss similarities and differences of teachers and coaches as learners. We will conclude with a discussion of implications of work intended to characterize teachers and coaches as learners. Specifically, we lead small and whole group discussions about the ways information about teachers and coaches as learners could be useful in developing learning trajectories that could be used by teacher educators for supporting the improvement of teaching and coaching practices.

Barlow, A.T., Burroughs, E.A., Harmon, S.E., Sutton, J.T., & Yopp, D.A. (2014). Assessing views of coaching via a video-based tool. *ZDM*, 46(2), 227-238.

Clements, D., & Sarama, J. (2004). Learning trajectories in mathematics education. *Mathematical Thinking and Learning*, 6(2), 81-89.

Common Core State Standards Initiative. (2010). *Common Core State Standards for Mathematics (CCSSM)*. Washington, DC: National Governors Association Center for Best Practices and the Council of Chief State School Officers.

Cuoco, A., Goldenberg, E. P., & Mark, J. (1996). Habits of mind: An organizing principle for mathematics curricula. *The Journal of Mathematical Behavior*, 15(4), 375-402.

Carlson, M.A., Williams, & Heaton, R.M. (accepted). Translating professional development for teachers into professional development for instructional leaders. *Mathematics Teacher Educator*.

National Council of Teachers of Mathematics, (NCTM) (2014). *Principles to actions*. Reston, VA: NCTM.

Van Es, E.A., & Sherin, M. G. (2002). Learning to notice: Scaffolding new teachers' interpretations of classroom interactions. *Journal of Technology and Teacher Education*, 10(4), 571-595.

Wilson, P. H., Mojica, G. F., & Confrey, J. (2013). Learning trajectories in teacher education: Supporting teachers' understandings of students' mathematical thinking. *The Journal of Mathematical Behavior*, 32(2), 103-121.



about Concurrent Sessions III (con't)

VICKI JACOBS & SUSAN EMPSON 3-5

Exploring the characteristics of one-on-one conversations with children when teachers circulate during problem-solving

Teachers have many one-on-one conversations with children about their mathematical work. Sometimes these conversations occur in pull-out situations, often for assessment or tutoring purposes. Other times, teachers engage in one-on-one conversations with children when they are circulating during problem solving. These conversations are critical for gathering information about children's strategies so that teachers can identify goals and select strategies to showcase during whole class discussions. An often overlooked additional benefit of these one-on-one conversations during problem solving is that they can be important learning spaces for both children and teachers when teachers spend time questioning individual children about their strategies. Children can benefit because teachers' questions can help them consolidate and advance their understandings. Teachers can benefit because their questions open a window into a particular child's way of reasoning—information that is important for planning future instruction.

In this session, we will explore the characteristics of these one-on-one conversations as potential learning spaces by examining data from a recent project, Responsive Teaching in Elementary Mathematics (RTEM). This project involved 72 grades 3-5 teachers who participated in 3 years of professional development focused on research-based knowledge of children's fraction thinking and how teachers could use this knowledge to be responsive to the children in their classes. Teachers were asked to engage with sets of student strategies (presented either on video or as written work) and then anticipate what one-on-one conversations they would like to have with those children. We were interested in how teachers decided which strategies required further conversation beyond a brief check-in, and how teachers thought about the goals and substance of those conversations. We found patterns in terms of which strategies teachers chose to address and the types of conversations they planned to have. Because the characteristics of the questions proposed by teachers who built on children's thinking and those who did not were strikingly different, there are implications for professional development and teachers' self reflection. We will explore data and findings from the RTEM project while highlighting the potential power of one-on-one conversations during problem solving.

Examples will be drawn from work at the upper elementary school level in the area of fractions, but ideas should apply throughout the elementary school grades.

CATHY MARTIN K-12

Mathematical modeling: an evolving perspective

Mathematical modeling is a conceptual category in the high school Common Core Standards, a Standard for Mathematical Practice in the Common Core for students in all grades, and a topic that connects with other content areas. In this session, participants will extend and deepen understanding of Math Practice 4: model with mathematics through a variety of learning activities using resources from the Guidelines for Assessment & Instruction in Mathematical Modeling Education (GAIMME, a report released in April 2016), the 2016 *Annual Perspectives in Mathematics Education: Mathematical Modeling and Modeling and Mathematics* (NCTM), and other recent publications.

Participants will begin the session with exploring the different views of mathematical modeling and then explore how mathematical modeling can improve the teaching and learning of mathematics across K-12. With this perspective, participants will analyse a set of tasks to determine the aspects of mathematical modeling in each. Participants will also explore how to modify existing tasks (or word problems) to develop mathematical modeling problems.



about Concurrent Sessions III (con't)

NANETTE SEAGO & KAREN KOELLNER 6-12

How does video-based professional development influence teacher practice?

In this session we will explore what teachers took back to their classrooms based on a specified video-based professional development experience. Questionnaire data, focus group conversations and video from professional development sessions were qualitatively analysed to triangulate data on teachers' learning and uptake from the professional development. Teachers were classified into four different user categories -- Generative, Transformative, Incremental, or Non Users -- based on how the teachers carried their professional development experiences into their mathematics classrooms. Teachers differed in their classifications based on their mathematical understandings and contextual influences. These classifications help us to understand how and why teachers take up learning from professional development programs in unique ways and to varying degrees.

During this two-hour session, participants will learn about the specified video-based professional development design, experience two abbreviated video case experiences, and participate in collectively analysing and categorizing teacher data. Participants will reflect on these categories in light of their own contexts and share agreements, disagreements and additions.



about Concurrent Sessions IV (Friday 8:00 am - 10:00 am)

AMANDA (MANDY) JANSEN 6-12

Rough Draft Thinking: points of entry & deeper dives

In this session, we will think together about why teachers (with whom I have worked in professional development) were interested in incorporating rough draft thinking into their mathematics classrooms. I will share how they connected rough draft thinking to goals that they already had for their classrooms, and how rough draft thinking was helpful to different teachers in different ways. Teachers had various points of entry that attracted them to engaging their students in rough draft thinking. As a part of having varying points of entry and purposes, they enacting and promoted rough draft thinking in their classrooms in various ways (including creating some new instructional routines or repurposing instructional routines they valued already).

Thus, after I introduce the concept of rough draft thinking, which may be familiar to previous TDG Leadership Seminar participants, the new idea in this year's session will be these points of entry -- different "hooks" that drew different teachers in to be interested in rough draft talk -- and deeper dives, such as how rough draft thinking inspired teachers to develop new instructional practices. I will also share my own narrative about how my thinking about rough draft thinking has evolved over time, and what counted as a "deeper dive" for me.

Take away ideas from this session will include (re-)visiting the concept of rough draft thinking, a consideration of how rough draft thinking can help teachers address a variety of dilemmas in their classrooms (to support the work of teacher leaders), and reflection opportunities to help us all take deeper dives into thinking about how rough draft thinking supports ongoing learning and issues of equity and access.

MIKE FLYNN K-8

Unlocking the power of problem-based learning: supporting teachers in creating and implementing rich tasks

Problem-based learning is a powerful learner-centered approach in which students learn mathematical concepts by working through an open-ended or open middle task. Rather than providing direct instruction on a particular method that students should use and then having students solve the problem with that method, problem-based learning involves starting with the problem first and having students develop their own solution pathways. Problem-based learning tasks require students to define the question, find the relevant information necessary to solve the problem, decide which tools are needed, evaluate possible approaches, solve the problem, share their findings, and compare their reasoning to others. This session will draw upon Mike's recent work on task development and implementation with K-8 students as well as adult learners.

During this session, participants will engage in a variety of problem-based learning activities including 3-act math tasks, open-middle problems, and open-ended tasks. We will explore how these tasks can be used to support student learning and for staff development. Participants will learn protocols for creating rich tasks, explore rubrics for task analysis, and learn effective instructional strategies when implementing a problem-based learning approach. Participants will leave with a variety of resources to support teachers, including links to hundreds of tasks, planning guides, templates, articles, and access to an online repository of problem-based learning resources.

DIANE BRIARS K-12

Adopting new math books? Start by selecting an effective textbook analysis toolkit to inform your work!

Participants will explore the recently updated *NCSM/NCTM Curriculum Analysis Toolkit* for evaluating the quality of instructional materials. The toolkit was originally developed by a national committee of respected mathematics education leaders under the direction of the Council of Chief State School Officers. It provides tools for analyzing materials in terms of mathematics Content, Practices, and Overarching Considerations (Technology, Equity and Assessment). New resources include: *Look For Guides* to focus users on important textbook and rubric features and *Textbook Analysis Professional Learning Activities* designed to help leaders build a shared vision of effective textbook design among members of their selection committees.

During this session, participants will be introduced to the tools and have an opportunity to apply them to analyze sample lessons from different curricular materials.



about Concurrent Sessions IV (con't)

ANURUPA GANGULY 6-12

Developing 'Function Sense' for teachers and students through the art of conjecturing

The eight mathematical practice standards outlined by the CCSS-M seek to engage our K-12 students in the processes and patterns of thinking required for the making and growing of mathematics. Though the making and exploration of conjectures is an essential component of these practices, it often remains underrepresented in our secondary mathematics curriculum. Inviting conjectures, which often build from apparent inconsistencies or seemingly unintuitive premises, not only afford our students of school mathematics the opportunity to invent, create and explore mathematical statements and constructs, it also supports the belief that mathematics is not a closed canon but one that continuously grows in theory and application.

In this session, participants will explore ways to pose questions that lead teachers and students to make authentic conjectures - specifically about the behaviors of various function types and their underlying structure. We begin with the Functions domain because Functions serve as an important mathematical object in the middle and high grades. More often than not we employ narrow questioning patterns that encourage students to memorize certain attributes of a function type and apply that set to similar problem types. Instead, we should aim to ensure that students reach a level of fluency, ease and comfort with Functions and their manipulations and transformations in a variety of situations, which we coin as Function Sense (a parallel to Number Sense in the elementary grades).

In addition to examining the questioning patterns that encourage authentic conjectures, we will employ open source online platforms that provide space to explore new graphical representations of functions in an effort to test and confirm our conjectures. This initial toolkit of strategies and resources will springboard a greater conversation around ways to routinize the important skill of Function Sense, as well bring in the art of conjecturing in other domains of mathematics teaching and learning. If possible, please bring a laptop to the session, as some of the activities will require participants to use the online platforms.

RUTH HEATON, MICHELLE METZGER & MOLLY WILLIAMS K-5

Capitalizing on the visibility of practice within Math Studio to understand teachers and coaches as learners

Since 2011, Heaton has been leading versions of Math Studio in elementary schools in one urban and one suburban school district in Nebraska building off the Math Studio model of Teachers Development Group. Nebraska's Math Studio model was originally focused as a learning opportunity for classroom teachers. However, over time, the participants and the goals of Math Studio were redesigned to meet the needs of varied participants (Carlson, Williams, & Heaton, accepted).

Our first redesign expanded participants of Math Studio from only teachers to include math coaches as well as school and district administrators. The focus was on deepening everyone's understanding of math teaching (e.g. NCTM 2014) and learning practice (e.g. Cuoco, Goldenberg, & Mark, 1996; CCSS Initiative, 2010) While the participants remained the same, over time, we began to individualize learning goals for the varied participants. We began each Math Studio with distinct learning goals about improving teaching for teachers, improving methods of supporting teachers for coaches, and expanding and strengthening the math leadership voice of the administrator to one of helping teachers reflect on their own math teaching practices and evaluating math instruction in ways that align with current reforms. Our latest iteration involves a Math Studio attentive to the improvement of math teaching practices within a Math Studio focused on the improvement of coaching practices (Barlow, Burroughs, Harmon, Sutton, & Yopp, 2014).

Visibility of dilemmas and decisions that undergird coaching, teaching, and learning practices is a common feature across all Math Studios, given the public nature of practice that characterizes Math Studio, no matter who the specific participants nor what the specific goals are. Based on what teachers and coaches notice (Van Es & Sherin, 2002) and how we see and hear them respond to one another or the facilitator within Math Studio, we can begin to make some conjectures about who they are as learners. We can begin to identify strengths and limitations in their understandings of math, pedagogy, and their learners, and we can begin to surmise what they have yet to learn. Just as the ongoing analysis of students' understanding is essential to target future instruction and improve mathematical understanding (e.g. Clements & Sarama, 2004; Wilson, Mojica & Confrey, 2013), so too is the need to analyze the learning of teachers as well as math coaches, formatively assess learning, and plan



about Concurrent Sessions IV (con't)

future goals for professional development opportunities.

In this session, we will share our preliminary understanding of the variance that exists among teachers as learners and coaches as learners based upon the data we have gathered in the context of Math Studio. In the session, participants will first examine excerpts from our data drawn from planning, teaching and debriefing sessions from our teaching and coaching Math Studios. Specifically, we will share contrasting collections of data excerpts from a small subset of the 18 Math Studio teachers and 16 math coaches with whom we have worked. We will facilitate small and large group discussion among session participants about the common and disparate characteristics of teachers and coaches as learners based on our data. We will also give session participants opportunities to link our experiences, as represented by data, with their own in an effort to discuss similarities and differences of teachers and coaches as learners. We will conclude with a discussion of implications of work intended to characterize teachers and coaches as learners. Specifically, we lead small and whole group discussions about the ways information about teachers and coaches as learners could be useful in developing learning trajectories that could be used by teacher educators for supporting the improvement of teaching and coaching practices.

Barlow, A.T., Burroughs, E.A., Harmon, S.E., Sutton, J.T., & Yopp, D.A. (2014). Assessing views of coaching via a video-based tool. *ZDM*, 46(2), 227-238.

Clements, D., & Sarama, J. (2004). Learning trajectories in mathematics education. *Mathematical Thinking and Learning*, 6(2), 81-89.

Common Core State Standards Initiative. (2010). *Common Core State Standards for Mathematics (CCSSM)*. Washington, DC: National Governors Association Center for Best Practices and the Council of Chief State School Officers.

Cuoco, A., Goldenberg, E. P., & Mark, J. (1996). Habits of mind: An organizing principle for mathematics curricula. *The Journal of Mathematical Behavior*, 15(4), 375-402.

Carlson, M.A., Williams, & Heaton, R.M. (accepted). Translating professional development for teachers into professional development for instructional leaders. *Mathematics Teacher Educator*.

National Council of Teachers of Mathematics, (NCTM) (2014). *Principles to actions*. Reston, VA: NCTM.

Van Es, E.A., & Sherin, M. G. (2002). Learning to notice: Scaffolding new teachers' interpretations of classroom interactions. *Journal of Technology and Teacher Education*, 10(4), 571-595.

Wilson, P. H., Mojica, G. F., & Confrey, J. (2013). Learning trajectories in teacher education: Supporting teachers' understandings of students' mathematical thinking. *The Journal of Mathematical Behavior*, 32(2), 103-121.

AMY LUCENTA & GRACE KELEMANIK K-12

Construct and critique: an instructional routine

Last year at the TDG Leadership Seminar, we shared a process to design instructional routines, and, with participants insight, drafted an instructional routine to develop math practice 3—Construct Viable Arguments and Critique the Reasoning of Others. Since then, we took ideas from the group, designed the instructional routine, and refined it to its current state.

The Construct and Critique instructional routine serves to develop students' capacity to make sense of, analyze, and critique mathematical thinking, and then use their analysis to construct a viable mathematical argument to justify or counter the mathematical thinking they've analyzed. Students will be poised to apply this mathematical practice as they consider their own work, others' thinking, or read math texts.

This instructional routine supports teachers as they place a premium on the development of mathematical language and argument. In addition, Critique and Construct provides opportunities for teachers to highlight and discuss common errors their students are making or a misconception their students hold, or to introduce a new representation, strategy or approach that deepens conceptual understanding.

During this session, participants will experience the Construct and Critique routine, reflect on the flow, the designs for student engagement, and supports for all learners. Participants will provide feedback on the routine, and leave prepared to share the instructional routine with students, coaches, and teachers.



about Concurrent Sessions IV-V (Double Sessions, Friday 8:00 am - 12:15 pm)

MARY BEISIEGEL K-12

To know or not know? To lead or not lead? Important questions and findings from a video-based professional development study

Video cases and video clubs have become popular forms of teacher professional development. However, there have been few systematic investigations of designs for such programs. Two ways in which video-based professional development programs may vary include: (a) whether teachers watch video of their own and their peers' instruction, or whether they watch stock video of unknown teachers; and (b) whether discussions about video clips are led by trained facilitators or by participants themselves. In the case of video type, might teachers find more meaning in watching and discussing their own or their peers' lessons or lessons of unknown teachers? In the case of facilitation type, can discussions led by teachers maintain the focus and depth of sessions led by trained facilitators?

In this session, I will describe a study in which twelve groups of teachers were in one of four professional development groups: own video-facilitator-led, own-video-teacher-led, stock-video-facilitator-led, stock-video-teacher-led. I will share the findings from the study and the implications for how teacher leaders might structure video-based professional development. Next, I will introduce the observational tool (the Mathematical Quality of Instruction instrument) used in the study which provided teachers with a common language and a framework through which to view and discuss teaching. Then, using video clips of teachers' lessons on fractions, we will explore the usefulness of video analysis, the MQI, and design of professional development programs that would be applicable in participants' schools.



about Concurrent Sessions V (Friday 10:15 am - 12:15 am)

KRISTEN BIEDA K-12

Share your knowledge in the Mathematics Teacher Educator

Mathematics Teacher Educator (MTE) is an online, peer-reviewed journal, jointly published by National Council for Teachers of Mathematics and the Association for Mathematics Teacher Educators, that features articles which add to the knowledge base related to the practice of mathematics teacher educators. The journal provides a means for practitioner knowledge related to the preparation and support of teachers of mathematics to be not only public, shared, and stored, but also verified and improved over time (Hiebert, Gallimore, and Stigler 2002). The primary audience of Mathematics Teacher Educator is practitioners in mathematics teacher education, with practitioner broadly defined as anyone who contributes to the preparation and professional development of pre-K–12 pre-service and in-service teachers of mathematics... in essence... YOU!

This session will share information with TDG participants about preparing a manuscript for submission to MTE. During the session, participants will hone an idea for a MTE publication through several activities, including an opportunity to sketch an idea using a template for MTE manuscripts, crafting a draft abstract and critiquing examples of abstracts from published (and unpublished) manuscripts, and analyzing drafts of a published MTE article from first submission to accepted publication. There will also be time for Q&A with Dr. Bieda, the current Associate Editor of MTE.

HILDA BORKO & ANTHONY VILLA K-12

Preparing teacher leaders to facilitate video-based discussions in mathematics professional development

This session will focus on facilitation practices for planning and leading video-based discussions (VBD) in mathematics professional development workshops. We will begin the session by introducing the Problem-Solving Cycle of mathematics professional development and Mathematics Leadership Preparation model for preparing teacher leaders to facilitate the Problem-Solving Cycle. Participants will then engage in three major activities. In the first activity, they will participate as teacher-learners in a video-based discussion led by one of us. The video will be of a small group problem-solving activity in a middle school mathematics classroom. The discussion will focus on the CCSSM mathematical practices. In the second activity, the second member of our team will debrief the facilitator, asking questions to highlight aspects of facilitation such as selecting a goal and video clip for the video-based discussion; planning launching and "back-pocket" questions; and specific moves made during the discussion and reasons for those moves. Participants will also have an opportunity to ask questions about the video-based discussion. In the third activity, participants will watch a video clip of two members of our project team leading a video-based discussion with the school-based teacher leaders during a Teacher Leader Preparation meeting and identify the different types of facilitation moves they notice. We will then discuss the different types of facilitation moves and their purposes, as well as challenges that facilitators face when leading video-based discussions with teachers.

The video clips are drawn from our current work preparing middle school teacher leaders in a large urban district to implement the Problem-Solving Cycle model of mathematics professional development with teachers in their schools. The Problem-Solving Cycle is an iterative, long-term approach to mathematics professional development. One major component of the model entails using video clips from participating teachers' own lessons to deeply explore mathematical concepts, students' mathematical reasoning, and instructional strategies for teaching with rich problems. The district recently developed a task-based mathematics curriculum for grades K-8. It is now focused on providing school-based professional development to support teachers' implementation of the curriculum, and on building capacity within the district to lead the professional development effort. The teacher leaders, most of whom are new to this role, have found these three types of activities to be particularly powerful learning opportunities.



about Concurrent Sessions V (con't)

VICKI JACOBS & SUSAN EMPSON 3-5

Exploring the characteristics of one-on-one conversations with children when teachers circulate during problem-solving

Teachers have many one-on-one conversations with children about their mathematical work. Sometimes these conversations occur in pull-out situations, often for assessment or tutoring purposes. Other times, teachers engage in one-on-one conversations with children when they are circulating during problem solving. These conversations are critical for gathering information about children's strategies so that teachers can identify goals and select strategies to showcase during whole class discussions. An often overlooked additional benefit of these one-on-one conversations during problem solving is that they can be important learning spaces for both children and teachers when teachers spend time questioning individual children about their strategies. Children can benefit because teachers' questions can help them consolidate and advance their understandings. Teachers can benefit because their questions open a window into a particular child's way of reasoning—information that is important for planning future instruction.

In this session, we will explore the characteristics of these one-on-one conversations as potential learning spaces by examining data from a recent project, Responsive Teaching in Elementary Mathematics (RTEM). This project involved 72 grades 3-5 teachers who participated in 3 years of professional development focused on research-based knowledge of children's fraction thinking and how teachers could use this knowledge to be responsive to the children in their classes. Teachers were asked to engage with sets of student strategies (presented either on video or as written work) and then anticipate what one-on-one conversations they would like to have with those children. We were interested in how teachers decided which strategies required further conversation beyond a brief check-in, and how teachers thought about the goals and substance of those conversations. We found patterns in terms of which strategies teachers chose to address and the types of conversations they planned to have. Because the characteristics of the questions proposed by teachers who built on children's thinking and those who did not were strikingly different, there are implications for professional development and teachers' self reflection. We will explore data and findings from the RTEM project while highlighting the potential power of one-on-one conversations during problem solving.

Examples will be drawn from work at the upper elementary school level in the area of fractions, but ideas should apply throughout the elementary school grades.

AMY LUCENTA & GRACE KELEMANIK K-12

Construct and critique: an instructional routine

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During this session, participants will experience the Construct and Critique routine, reflect on the flow, the designs for student engagement, and supports for all learners. Participants will provide feedback on the routine, and leave prepared to share the instructional routine with students, coaches, and teachers.



about Concurrent Sessions V (con't)

SUSAN JO RUSSELL & DEBORAH SCHIFTER K-12

Mathematical argument in the elementary classroom: a model for teachers and coaches

Mathematical argument can and should be a regular, ongoing part of mathematics instruction in grades 2 through 5. This session presents a teaching model, illustrated with video examples, in which students engage in activities that involve examining sets of related problems or arithmetic expressions, articulating conjectures of what they notice, and using representations to construct arguments. Informed by previous research on young students' engagement with mathematical argument (c.f., Kaput, Carragher, Blanton (Eds.), 2007; A. Stylianides, 2010), the presenters worked with 21 collaborating teachers over three school years, studying teachers' written accounts and videotapes of classroom sessions, resulting in a teaching model for engaging students in mathematical argument. We also developed eight lesson sequences which were implemented and refined in those classrooms.

In this session, we will present the results of this research in the form of video examples that illustrate the five phases of the model.

NANETTE SEAGO & KAREN KOELLNER 6-12

How does video-based professional development influence teacher practice?

In this session we will explore what teachers took back to their classrooms based on a specified video-based professional development experience. Questionnaire data, focus group conversations and video from professional development sessions were qualitatively analysed to triangulate data on teachers' learning and uptake from the professional development. Teachers were classified into four different user categories -- Generative, Transformative, Incremental, or Non Users -- based on how the teachers carried their professional development experiences into their mathematics classrooms. Teachers differed in their classifications based on their mathematical understandings and contextual influences. These classifications help us to understand how and why teachers take up learning from professional development programs in unique ways and to varying degrees.

During this two-hour session, participants will learn about the specified video-based professional development design, experience two abbreviated video case experiences, and participate in collectively analysing and categorizing teacher data. Participants will reflect on these categories in light of their own contexts and share agreements, disagreements and additions.





about Concurrent Sessions VI (Friday 3:15 pm - 5:15 pm)

KRISTEN BIEDA K-12

Share your knowledge in the Mathematics Teacher Educator

Mathematics Teacher Educator (MTE) is an online, peer-reviewed journal, jointly published by National Council for Teachers of Mathematics and the Association for Mathematics Teacher Educators, that features articles which add to the knowledge base related to the practice of mathematics teacher educators. The journal provides a means for practitioner knowledge related to the preparation and support of teachers of mathematics to be not only public, shared, and stored, but also verified and improved over time (Hiebert, Gallimore, and Stigler 2002). The primary audience of Mathematics Teacher Educator is practitioners in mathematics teacher education, with practitioner broadly defined as anyone who contributes to the preparation and professional development of pre-K-12 pre-service and in-service teachers of mathematics... in essence... YOU!

This session will share information with TDG participants about preparing a manuscript for submission to MTE. During the session, participants will hone an idea for a MTE publication through several activities, including an opportunity to sketch an idea using a template for MTE manuscripts, crafting a draft abstract and critiquing examples of abstracts from published (and unpublished) manuscripts, and analyzing drafts of a published MTE article from first submission to accepted publication. There will also be time for Q&A with Dr. Bieda, the current Associate Editor of MTE.

LYNSEY GIBBONS K-8

Using Number Talks to support student and teacher learning across a system

In this session, we will explore our efforts to support teachers to take up Number Talks across schools within our district. Number Talks are five- to fifteen-minute conversations around purposefully crafted problems during which students are asked to communicate their thinking when presenting and justifying solutions to problems they solve mentally. These exchanges can lead to students' development of more accurate, efficient, and flexible strategies. Number talks can also be an important tool for teachers' development. In this session, we explore our efforts to support teachers' learning about and use of Number Talks. We describe our journey to support Number Talks to be used routinely in classrooms across our school district, but were only moderately successful. When we began using a full day professional learning structure (called Math Labs) across some of our schools, our teachers were able to work together on planning and implementing Number Talks. These learning opportunities helped them to feel comfortable using Number Talks regularly in their classrooms. During the session, we will explore what Number Talks are, as well as the professional learning design that supported our teachers' learning and development.

AMANDA (MANDY) JANSEN K-12

Rough Draft Thinking: points of entry & deeper dives

In this session, we will think together about why teachers (with whom I have worked in professional development) were interested in incorporating rough draft thinking into their mathematics classrooms. I will share how they connected rough draft thinking to goals that they already had for their classrooms, and how rough draft thinking was helpful to different teachers in different ways. Teachers had various points of entry that attracted them to engaging their students in rough draft thinking. As a part of having varying points of entry and purposes, they enacting and promoted rough draft thinking in their classrooms in various ways (including creating some new instructional routines or repurposing instructional routines they valued already).

Thus, after I introduce the concept of rough draft thinking, which may be familiar to previous TDG Leadership Seminar participants, the new idea in this year's session will be these points of entry -- different "hooks" that drew different teachers in to be interested in rough draft talk -- and deeper dives, such as how rough draft thinking inspired teachers to develop new instructional practices. I will also share my own narrative about how my thinking about rough draft thinking has evolved over time, and what counted as a "deeper dive" for me.

Take away ideas from this session will include (re-)visiting the concept of rough draft thinking, a consideration of how rough draft thinking can help teachers address a variety of dilemmas in their classrooms (to support the work of teacher leaders), and reflection opportunities to help us all take deeper dives into thinking about how rough draft thinking supports ongoing learning and issues of equity and access.



about Concurrent Sessions VI (con't)

GRACE KELEMANIK, AMY LUCENTA, SONJA KUOKKANEN & NATALIYA PAQUETTE K-12

Coaching so it sticks: leveraging instructional routines to develop math teaching practices

For many teachers taking on high leverage instructional practices like the eight NCTM Mathematical Teaching Practices will require developing different teaching muscles. For example, in order to effectively elicit and use evidence of student thinking and facilitate meaningful mathematical discourse (two of the NCTM practices) a teacher must be able to quickly scan student writing and listen in on snippets of student conversation to determine how individual students (and the class as a whole!) are making sense of the math at hand, what misconceptions and partial understanding they have, and then based on that which ideas to bring to the full group, in what order, and what connecting questions to ask. This capacity to take in a flood of information quickly and make on-the-spot strategic instructional decisions based on it takes practice. And this practice necessitates a shift in coaching support.

The traditional coaching structure -- pre-conference, observation, and debrief -- is effective when teachers are trying out a new classroom structure or resource or in helping teachers reflect on their practice. However, developing a new teaching habit -- especially one that requires building a different teaching muscle-- must be coached in real time. To help teachers build new teaching muscles, coaching will need to become more in-the-moment than after-the-fact; and it will need to become routine.

Instructional routines are indispensable coaching tools not just because their repeatable structure invites the formation of habits, but also because their consistent lesson design allows for a focus on the complexities of teaching rather than the logistics of the lesson, and invites collaborative learning. Coaching through an instructional routine allows everyone -- the teacher, their colleagues, and the coach-- to walk into any coaching session ready to immediately begin working on the crux of the lesson -- the mathematics, how students make sense of it, and how the teacher supports that sense making.

In this session, we will lay out coaching shifts that support significant and long lasting change in teacher practice. Participants will learn about specific coaching strategies that align with these shifts. They will analyze coaching video and engage in mini coaching sessions to develop images of the coaching shifts and strategies in action.

ELIZABETH PHILLIPS & YVONNE GRANT 5-10

Arc of Learning framework: developing conceptual understanding

Learning progressions show how students' prior knowledge and experiences build over time from informal knowledge into more sophisticated reasoning (Clements & Sarama, 2004; Sztajn, Confrey, Wilson, & Edgington, 2012). Learning progressions involve purposeful sequences of problems that provide students opportunities to build and articulate connections among ideas and to develop a view of mathematics as a coherent and connected discipline (Fosnot & Jacobs, 2010). In problem-centered curriculum materials, problems refer to contextual task situations that support some or all of the following (Lappan & Phillips, 2009): (a) has important, useful mathematics embedded in it, (b) promotes conceptual and procedural knowledge, (c) builds on and connects to other important mathematical ideas, (d) requires higher-level thinking, reasoning, and problem solving (e.g., mathematical practices), (e) provides multiple access points for students, (f) engages students and promotes classroom discourse, and (g) creates an opportunity for teachers to access student learning (e.g., formative assessment).

The Arc of Learning framework (Phillips et al, 2014) describes student development of mathematical understandings for key concepts and methods. This framework moves the learning focus beyond the analysis of isolated tasks to consider the role of a problem and its location in a connected sequence of problems for promoting conceptual understanding of mathematics. To make explicit the learning progressions of a problem-centered curriculum, the Arc of Learning framework consists of five phases that describe a learning process for students as they explore mathematics problems over time (Edson et al, 2015). The five phases are Introducing (Setting the Scene), Exploring (Mucking About), Analyzing (Going Deeper), Synthesizing (Looking Across, and Abstracting (Going Beyond.) The processes of connecting, reflecting, assessing, and mathematical practices span across the five phases.



about Concurrent Sessions VI (con't)

The goal of the session is to use the Arc of Learning to examine how middle grades students' mathematical learning develops over time. The unit on linear functions, Moving Straight Ahead, from the algebra strand and Let's Be Rational from the number strand in the Connected Mathematics curriculum will be used to guide the exploration and discussions. By the end of the session, participants will have had opportunities to:

- Discuss the Arc of Learning, its five phases, and its underlying research base on how students mathematical learning is developed;
- Engage in a hands-on activity designed around constructing sequences of mathematics problems, their mathematical goals, and potential student thinking resulting from the problem-solving tasks;
- Report out and reflect on the outcomes of the analyses, including points of agreement and disagreement as well as unit specific frameworks; and
- Discuss implications and recommendations for how research and practice activities can be informed by the Arc of Learning.

Clements, D. H., & Sarama, J. (2004). *Learning trajectories in mathematics education. Mathematical Thinking and Learning*, 6(2), 81-89.

Edson, A.J., Gilbertson, N.J., Gonulates, F., Grant, Y., Nimtz, J.L., Phillips, E., & Satyam, V.R. (2015). *Studying the arc of learning in middle school mathematics curriculum materials*. In T.G. Bartell, K.N. Bieda, R.T. Putnam, K. Bradfield, & H. Dominguez (Eds.) *Proceedings of the 37th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 104-107). East Lansing, MI: Michigan State University.

Fosnot, C.T., & Jacobs, W. (2010). *Young mathematicians at work: Constructing algebra*. Portsmouth, NH: Heinemann.

Lappan, G., & Phillips, E. (2009). *A designer speaks: Challenges in US mathematics education through a curriculum developer's lens. Educational Designer*, 2(1).

Phillips, E., Gilbertson, N., Grant, Y., & Stewart, J. (2014, April). *New standards and classic problems: the case of CMP*. Paper presented at the annual National Council of Supervisors of Mathematics conference, New Orleans, Louisiana.

Sztajn, P., Confrey, J., Wilson, P.H., & Edgington, C. (2012). *Learning trajectory based instruction: Toward a theory of teaching. Educational Researcher*, 41(5), 147-156.

SUSAN JO RUSSELL & DEBORAH SCHIFTER K-5

Mathematical argument in the elementary classroom: a model for teachers and coaches

Mathematical argument can and should be a regular, ongoing part of mathematics instruction in grades 2 through 5. This session presents a teaching model, illustrated with video examples, in which students engage in activities that involve examining sets of related problems or arithmetic expressions, articulating conjectures of what they notice, and using representations to construct arguments. Informed by previous research on young students' engagement with mathematical argument (c.f., Kaput, Carraher, Blanton (Eds.), 2007; A. Stylianides, 2010), the presenters worked with 21 collaborating teachers over three school years, studying teachers' written accounts and videotapes of classroom sessions, resulting in a teaching model for engaging students in mathematical argument. We also developed eight lesson sequences which were implemented and refined in those classrooms.

In this session, we will present the results of this research in the form of video examples that illustrate the five phases of the model.



about Concurrent Sessions VI (con't)

MIKE SHAUGHNESSY, KATE MELHUISH, EVA THANHEISER & JULIE FREDERICKS K-12

The Math Habits & Routines Classroom Observation Tool: connecting teacher moves and student reasoning

Measuring the degree of teacher implementation of critical components of professional development is often cited as the essential link when evaluating the effectiveness and efficacy of professional development programs (O'Donnell, 2008). As part of a large-scale efficacy study supported by the National Science Foundation, we have developed a tablet-based classroom observation tool to measure the implementation level of teacher participants and their students. As with other tools (e.g., Boston, Bostic, Lesseig, & Sherman, 2015), we also use this tool to support mathematics teachers and leaders in their professional learning.

The *Math Habits and Routines Classroom Observation Tool* is a tablet application that aims to capture: (1) the type of reasoning and discourse that students engage in, and (2) what teachers are doing to catalyze student reasoning and discourse. The power of this tool lies in the ability to make connect students' mathematical engagement and the teacher's use of teaching habits and routines. The tool (still in pilot stage) is rooted in research on effective teaching, learning, and professional development and was developed in an effort to capture classroom implementation of research-based best practices (e.g. Smith, & Hughes, 2008) and high-level student reasoning (e.g. Henningsen & Stein, 1997).

In this session, we will view some video clips from a lesson as a context for introducing the *Math Habits and Routines* tablet application and we will discuss ways to use the application as both a research tool and as a learning/reflection tool that supports teachers and leaders in refining their practices. Tablets will be provided for groups of participants to share.



about Concurrent Sessions VII (Saturday 8:00 am - 10:00 am)

HAROLD ASTURIAS K-12

Maker Projects: activating students' agency, authority, and identity

How can we activate students' interest and curious minds in ways that ignite persistent engagement in science, technology, engineering, art, and mathematics learning, inquiry, and innovation? How do Maker Projects and lesson study promote a deeper understanding of the role that students' mathematical agency, authority, and identity (AAI) play in the classroom? Learn how we've been working with K-8 teachers to create powerful mathematics classrooms where students develop robust understanding of the concepts they are learning and the academic language to communicate their reasoning.

VIRGINIA BASTABLE K-9

Changing the domain from whole to rational: expanding mathematical knowledge in the context of division. How is working on such ideas with adult learners similar to and different from working with elementary-aged students?

Participants in this session will:

- Explore meanings of division and how they are exemplified through story contexts.
- Consider what modifications are needed to when the divisor is larger than the dividend.
- Examine the connections across story situation, equations and visual representations.
- Analyze a case of adult learners working on this math
- Discuss the implications of this work for the teachers with whom they work.

CCSSM states that students apply and extend previous understandings of whole numbers to work with rational numbers. However, few math educators have had the opportunity to learn mathematics as a coherent set of ideas that is modified as the number domains change from whole to rational. This session will provide opportunities for participants to expand their own mathematical knowledge through small group discussion, sharing of ideas, and collaborating with others. The session will also include analysis of a case examining adult learners working on this mathematical idea to support discussion of how working on mathematical ideas is the same and different when the audience is adults or students.

HILDA BORKO & ANTHONY VILLA K-12

Preparing teacher leaders to facilitate video-based discussions in mathematics professional development

This session will focus on facilitation practices for planning and leading video-based discussions (VBD) in mathematics professional development workshops. We will begin the session by introducing the Problem-Solving Cycle of mathematics professional development and Mathematics Leadership Preparation model for preparing teacher leaders to facilitate the Problem-Solving Cycle. Participants will then engage in three major activities. In the first activity, they will participate as teacher-learners in a video-based discussion led by one of us. The video will be of a small group problem-solving activity in a middle school mathematics classroom. The discussion will focus on the CCSSM mathematical practices. In the second activity, the second member of our team will debrief the facilitator; asking questions to highlight aspects of facilitation such as selecting a goal and video clip for the video-based discussion; planning launching and "back-pocket" questions; and specific moves made during the discussion and reasons for those moves. Participants will also have an opportunity to ask questions about the video-based discussion. In the third activity, participants will watch a video clip of two members of our project team leading a video-based discussion with the school-based teacher leaders during a Teacher Leader Preparation meeting and identify the different types of facilitation moves they notice. We will then discuss the different types of facilitation moves and their purposes, as well as challenges that facilitators face when leading video-based discussions with teachers.

The video clips are drawn from our current work preparing middle school teacher leaders in a large urban district to implement the Problem-Solving Cycle model of mathematics professional development with teachers in their schools. The Problem-Solving Cycle is an iterative, long-term approach to mathematics professional development. One major component of the model entails using video clips from participating teachers' own



about Concurrent Sessions VII (con't)

Lessons to deeply explore mathematical concepts, students' mathematical reasoning, and instructional strategies for teaching with rich problems. The district recently developed a task-based mathematics curriculum for grades K-8. It is now focused on providing school-based professional development to support teachers' implementation of the curriculum, and on building capacity within the district to lead the professional development effort. The teacher leaders, most of whom are new to this role, have found these three types of activities to be particularly powerful learning opportunities.

LINDA RUIZ DAVENPORT, CONNIE HENRY & PETER THORLICHEN K-12

Supporting more equitable teaching practices during math instruction

Our session focuses on a collaboration with the district's K-12 math teacher leaders designed to promote more equitable teaching practices during math instruction across the district. These K-12 math teacher leaders, representing elementary, middle, and high schools grade bands across the district, are selected by application and meet with us for 3 full-day sessions and 3 after-school sessions during the school year.

These K-12 math teacher leaders are expected to use what they are learning in our sessions to strengthen their own practice and engage their school colleagues and administrators in the work, as well, using a variety of school structures including Instructional Leadership Teams (ILTs), Math Leadership Teams (MLTs), common planning time (CPTs), and secondary math department meetings.

Our math teacher leadership work this year draws on the *Mathematics Education Through the Lens of Social Justice: Acknowledgment, Actions, and Accountability* document from NCSM and TODOS and addresses the following goals: increasing the use of participation structures that maximize student contributions while minimizing status issues in the classroom; cultivating and sustaining a positive mathematics identity and affect; focusing on mathematical strengths and areas of growth with targeted meaningful feedback; and adapting instruction that routinely connects children's mathematical thinking to students' funds of knowledge. These goals build on work with our K-12 math teacher leaders in previous years addressing CCSSM content and practice standards, formative assessment strategies and, last year, the math teaching practices in NCTM's Principles to Actions.

In our session, you will engage in a selection of activities from our first three teacher leadership sessions this year; discuss challenges and opportunities associated with these activities, and reflect on connections to your own role and context. We will also share our vision for the rest of the school year and for subsequent years.

CATHY MARTIN K-12

Mathematical modeling: an evolving perspective

Mathematical modeling is a conceptual category in the high school Common Core Standards, a Standard for Mathematical Practice in the Common Core for students in all grades, and a topic that connects with other content areas. In this session, participants will extend and deepen understanding of Math Practice 4: model with mathematics through a variety of learning activities using resources from the Guidelines for Assessment & Instruction in Mathematical Modeling Education (GAIMME, a report released in April 2016), the 2016 *Annual Perspectives in Mathematics Education: Mathematical Modeling and Modeling and Mathematics* (NCTM), and other recent publications.

Participants will begin the session with exploring the different views of mathematical modeling and then explore how mathematical modeling can improve the teaching and learning of mathematics across K-12. With this perspective, participants will analyse a set of tasks to determine the aspects of mathematical modeling in each. Participants will also explore how to modify existing tasks (or word problems) to develop mathematical modeling problems.



about Concurrent Sessions VII (con't)

SUSAN JO RUSSELL K-6

Focusing on equity while engaging elementary students in mathematical practices

As we developed a model for integrating mathematical argument into grades 2-5 instruction, we focused on how students with a history of poor or good performance in math become engaged in this practice. How did our collaborating teachers engage the range of students in their class together in significant work on conjecture and justification? We draw on our NSF-funded research, which examined how students in grades 2-5 learn about mathematical argument while deepening their understanding of the behavior of the operations and how teachers can implement mathematical argument as an ongoing, consistent part of their instruction. Participants will consider video examples to examine these questions.

