

LEADERSHIP SEMINAR ON MATHEMATICS PROFESSIONAL DEVELOPMENT

March 4-7, 2020 | Portland, Oregon



PROGRAM

Agenda, Speaker Biographies & Session Summaries

TEACHERS DEVELOPMENT GROUP



Acknowledgements

Teachers Development Group (TDG) is a nonprofit organization, founded in 1998 by Linda Foreman and colleagues, dedicated to improving all students' mathematical understanding and achievement through meaningful, effective professional development for teachers and school leaders. Linda had a vision of mathematics teaching, learning, and leadership that has fueled the preK-12 professional development work of TDG for more than 20 years. She also had a vision for the annual TDG Leadership Seminar. She saw it as an opportunity for TDG to host the country's leading researchers in math education in sharing their most recent ideas around a single chosen theme relevant to current issues in math education. Stimulated by the cutting edge ideas presented in researchers' sessions, the entire Seminar community of math education (i.e., teacher leaders, math coaches, school and district administrators, professional development providers, curriculum developers, and researchers) all engage together in conversation during and between Seminar sessions about how to better continue to support the learning of teachers and leaders to improve math education for all students. The goal of the 2020 Seminar is for all of us to become smarter about how to better support teachers and leaders in supporting students who are typically the most underserved by our nation's schools. The leadership and commitment offered by TDG Board of Directors, and the diligence and expertise offered by TDG Mathematics Professional Development Specialists as they engage in the day to day work of supporting math teachers and school leaders in school districts around the country, are key to the organization's overall success. I give my heartfelt thanks to each and every one of them as they make it possible for TDG to sponsor this annual event. Please talk with these people during the Seminar and ask them about their service for TDG and discuss your own work with them. You can recognize them by the red ribbons on their nametags.

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Special thanks are also extended to Kevin Foreman, Lisna Lai, Kalvi Sokk, Paul Navarre, Sengu Thomas and Karin Wandtke, whose skills and expertise support the success of this annual Seminar and the daily work of TDG. Additional thanks are extended to Joan Shaughnessy, who volunteers for this event, and Judy Martin, who is a year-round TDG volunteer.



seminar AGENDA

WEDNESDAY MARCH 4

7:30 am – 9:00 am	Registration and Pre-session Check-In	Mount Hood Foyer
9:00 am – 4:00 pm	<i>Leverage the Repeatable Nature of Reasoning Routines to Develop Equitable Math Teaching Practices (space available—see registration desk)</i>	Saint Helens
9:00 am – 4:00 pm	<i>Math Habits and Routines Practitioner Forum (session closed)</i>	Mount Adams
12:00 pm – 4:00 pm	<i>Math in Real Life, Southern Oregon ESD (session closed)</i>	Cascade
12:30 pm – 3:30 pm	Speaker Pre-session Luncheon	Garden
3:00 pm – 6:45 pm	Registration and Seminar Check-In	Mount Hood Foyer
5:30 pm – 6:45 pm	Opening Reception (Food Carts, Cash Bar)	Mount Hood Foyer
6:45 pm	Welcome - Ruth Heaton	Mount Hood Ballroom

Opening Keynote

Mount Hood Ballroom

Deborah Lowenberg Ball & Imani Masters Goffney

Mathematics Teaching and the Pursuit of Justice

TEAM COLLABORATION DURING THE SEMINAR

To capitalize on the potential of Team Collaboration, several spaces throughout the hotel have been designated specifically for Team Collaboration throughout this Seminar: Garden A, B, C, Garden Foyer, Cascade Foyer, Saint Helens Foyer. Check with Seminar registration to reserve a meeting room during non-session hours. If you are attending alone or with a team, also feel free to reach out to others to form or join a team because of shared needs or interests. You may also request a Teachers Development Group Math Professional Development Specialist to meet with you. Inquire at the registration desk.



THURSDAY MARCH 5

6:45 am – 8:00 am **Breakfast ~ Team Collaboration**

Mount Hood Foyer

8:00 am – 10:00 am **Concurrent 1**

Marta Civil & Linda Griffin *New Possibilities for Parents as Partners in the Mathematics Education of Bilingual Learners* (repeats Concurrent 7) **Saint Helens CD**

Deborah Schifter & Susan Jo Russell *Individual and Collective Mathematical Agency in Urban Classrooms* (repeats Concurrent 6) **Mount Hood A**

Mandy Jansen *Planning to Incorporate Rough Draft Thinking and Revising into Mathematics Lessons* (repeats Concurrent 6) **Mount Hood C**

Linda Davenport & Ondrea Johnston *Building School Capacity for More Equitable Teaching Practices through Math Teacher Leadership* (repeats Concurrent 4) **Cascade**

Peg Smith *The 5 Practices in Practice: Addressing the Challenges of Orchestrating Mathematics Discussions and Ensuring Equity (Secondary)* (no repeat) **Mount Adams**

10:00 am – 10:15 am **Transition**

Mount Hood Foyer

10:15 am – 12:15 pm **Concurrent 2**

Jackie Greenwood, Heather Bussmann & Rebekah Elliott *Teacher Leader Collaborations to Design, Enact, and Refine Mathematics Modeling Instructional Routines* (no repeat) **Saint Helens CD**

Vicki Jacobs *Building Understanding of Fractions by Using Equations That Capture Children's Ideas* (repeats Concurrent 5) **Mount Hood A**

Kara Jackson, Hilda Borko, Anita Lenges, & Michael Jarry-Shore *Using Data from "Practical Measures" to Reflect on and Improve Classroom Practice and Professional Learning* (repeats Concurrent 3) **Mount Hood C**

Alejandra Sorto *Exploring the Volume of Mayan and Egyptian Pyramids: Addressing Cultural Relevance and Mathematical Habits to Support the Learning of All Students* (repeats Concurrent 4) **Cascade**

Mike Flynn *Turning Adversaries Into Allies: Building Community-Wide Support for Equitable Initiatives in Math Education* (no repeat) **Mount Adams**



12:30 pm – 1:30 pm Lunch ~ Team Collaboration

Mount Hood Ballroom

1:30 pm – 2:50 pm Plenary A

Mount Hood Ballroom

Julia Aguirre & Erin Turner

Mathematical Modeling: A Critical Lever for Equity in K-12 Mathematics Education

2:50 pm – 3:15 pm Dessert Break

Mount Hood Foyer

3:15 pm – 5:15 pm Concurrent 3

Virginia Bastable & Kristine Ho *Redefining Math Instruction: Raising Issues of Identity, Coherence, & Assets Within an Urban School District* (repeats Concurrent 7) **Saint Helens AB**

Imani Masters Goffney *Transforming Mathematics Classrooms to Become Equitable and Empowering Spaces for Black and Brown Students: What Kinds of Learning Opportunities Should We Create?* (no repeat) **Saint Helens CD**

Robert Q. Berry III *How Do We Teachers Teach Black Kids? My Response* (no repeat) **Mount Hood A**

Kara Jackson, Hilda Borko, Anita Lenges, & Michael Jarry-Shore *Using Dave from “Practical Measures” to Reflect on and Improve Classroom Practice and Professional Learning* (repeats Concurrent 2) **Mount Hood C**

Kristin Bieda *Productive Disciplinary Engagement: A Framework to Support Equitable Opportunities to Learn Challenging Mathematics* (repeats Concurrent 7) **Cascade**

Peg Smith *The 5 Practices in Practice: Addressing the Challenges of Orchestrating Mathematics Discussions and Ensuring Equity (Elementary)* (repeats Concurrent 5) **Mount Adams**

5:15 pm – 6:30 pm Seminar Social ~ Light Fare and Cash Bar

Mount Hood Foyer



FRIDAY MARCH 6

6:45 am – 8:00 am **Breakfast ~ Team Collaboration** **Mount Hood Foyer**

8:00 am – 10:00 am **Concurrent 4**
Megan Brunner, Elyssa Stoddard & Rebekah Elliott *Mathematical Modeling Instructional Tools Fostering Student Agency and Equity* (repeats Concurrent 7) **Saint Helens AB**

Alejandra Sorto *Exploring the Volume of Mayan and Egyptian Pyramids: Addressing Cultural Relevance and Mathematical Habits to Support the Learning of All Students* (repeats Concurrent 2) **St. Helens CD**

Robert Q. Berry III *How Do We Teachers Teach Black Kids? My Response* (no repeat) **Mount Hood A**

Linda Davenport & Ondrea Johnston *Building School Capacity for More Equitable Teaching Practices through Math Teacher Leadership* (repeats Concurrent 1) **Mount Hood C**

Julia Aguirre & Erin Turner *Mathematizing the World with Mathematical Modeling K-5: Professional Learning with Elementary Teachers about Mathematical Modeling* (no repeat) **Cascade**

Megan Franke & Angela Turrou *From Counting to Problem Solving: Challenging Linear Notions of Learning* (repeats Concurrent 6) **Mount Adams**

10:00 am – 10:15 am **Transition** **Mount Hood Foyer**

10:15 am – 12:15 pm **Concurrent 5**

Johannah Nikula & Jill DePiper *Facilitating Mathematical Practices through Student-teacher Relationships and Diagrams: Focusing on Students who are English Learners* (repeats Concurrent 6) **Saint Helens CD**

Vicki Jacobs *Building Understanding of Fractions by Using Equations That Capture Children's Ideas* (repeats Concurrent 2) **Mount Hood A**

Cathy Martin *Building Capacity and Leadership to Support a District-wide Focus on K-12 Mathematics Teaching and Learning* (repeats Concurrent 6.) **Mount Hood C**

Amanda Sugimoto, Eva Thanheiser, Alejandra Sorto, Kate Melhuish & Christina Koehne *Supporting Teachers and Students in Making Meaning of Mathematical Tasks, Contexts, and/or Language* (repeats Concurrent 7) **Cascade**



Peg Smith *The 5 Practices in Practice: Addressing the Challenges of Orchestrating Mathematics Discussions and Ensuring Equity (Elementary)* (repeats Concurrent 3) **Mount Adams**

12:30 pm – 1:30 pm Lunch ~ Team Collaboration

Mount Hood Ballroom

1:30 pm – 2:50 pm Plenary B

Mount Hood Ballroom

Mike Flynn

Powerful Moments in Math Class: Redefining Mathematical Identities and Creating Positive Memorable Experiences for All Learners

2:50 pm – 3:15 pm Dessert Break

Mount Hood Foyer

3:15 pm – 5:15 pm Concurrent 6

Johannah Nikula & Jill DePiper *Facilitating Mathematical Practices through Student-teacher Relationships and Diagrams: Focusing on Students who are English Learners* (repeats Concurrent 5) **Saint Helens CD**

Deborah Schifter & Susan Jo Russell *Individual and Collective Mathematical Agency in Urban Classrooms* (repeats Concurrent 1) **Mount Hood A**

Cathy Martin *Building Capacity and Leadership to Support a District-wide Focus on K-12 Mathematics Teaching and Learning* (repeats Concurrent 5) **Mount Hood C**

Mandy Jansen *Planning to Incorporate Rough Draft Thinking and Revising into Mathematics Lessons* (repeats Concurrent 1) **Cascade**

Megan Franke & Angela Turrou *From Counting to Problem Solving: Challenging Linear Notions of Learning* (repeats Concurrent 4) **Mount Adams**

5:15 pm

Dinner On Your Own ~ Team Collaboration



SATURDAY MARCH 7

6:45 am – 8:00 am **Breakfast ~ Team Collaboration** **Mount Hood Foyer**

8:00 am – 10:00 **Concurrent 7**

Marta Civil & Linda Griffin *New Possibilities for Parents as Partners in the Mathematics Education of Bilingual Learners* (repeats Concurrent 1) **Saint Helens CD**

Virginia Bastable & Kristine Ho *Redefining Math Instruction: Raising Issues of Identity, Coherence, & Assets Within an Urban School District* (repeats Concurrent 3) **Mount Hood A**

Kristen Bieda *Productive Disciplinary Engagement: A Framework to Support Equitable Opportunities to Learn Challenging Mathematics* (repeats Concurrent 3) **Mount Hood C**

Megan Brunner, Elyssa Stoddard, & Rebekah Elliott *Mathematical Modeling Instructional Tools Fostering Student Agency and Equity* (repeats Concurrent 4) **Cascade**

Amanda Sugimoto, Eva Thanheiser, Alejandra Sorto, Kate Melhuish & Christina Koehne *Supporting Teachers and Students in Making Meaning of Mathematical Tasks, Contexts, and/or Language* (repeats Concurrent 5) **Mount Adams**

10:00 am – 10:15 am **Transition** **Mount Hood Foyer**

10:15 am – 12:00 pm **Closing Plenary** **Mount Hood Ballroom**

Robert Q. Berry III
Unpacking Culturally Relevant Pedagogy and Culturally Responsive Teaching in Mathematics: Connecting Theory to Practice

12:00 pm – 12:45 **Lunch ~ Team Collaboration ~ Closing** **Mount Hood Ballroom**
Drawing for an Apple Watch



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SPEAKERS & SESSIONS

about Julia Aguirre

Julia Aguirre is an Associate Professor in the School of Education at the University of Washington Tacoma. Her work examines equity in mathematics teaching and learning, teacher education, and culturally responsive mathematics pedagogy. A primary goal of her work is preparing new generations of teachers to make mathematics education accessible, meaningful and relevant to today's youth. Julia has worked in the field of mathematics education for over 20 years. She has taught middle and high school mathematics in formal and out-of-school settings. Julia has been a principal investigator on three NSF-funded projects: Center for the Mathematics Education of Latinos/as (CEMELA, CO-PI); Teachers Empowered to Advance Change in Mathematics (TEACH MATH, CO-PI); and Mathematical Modeling with Cultural and Community Contexts (M2C3, PI). In addition to numerous articles and book chapters, she is a co-author of, *The Impact of Identity in K-8 Mathematics: Rethinking Equity-based Practices* (Aguirre, Mayfield Ingram & Martin, 2013). She is co-editor of *Transforming Mathematics Teacher Education: An Equity-based Approach* (Bartell, Drake, Roth McDuffie, Aguirre, Turner & Foote, 2019). Julia has worked with K-12 teachers and teacher leaders in several states including Washington, California, Arizona, Illinois, and New York.

PLENARY A

Mathematical Modeling: A Critical Lever for Equity in K-12 Mathematics Education

Leading session with Erin Turner.

This interactive session will introduce mathematical modeling as an equity lever for K-12 mathematics education. Mathematical modeling leverages student understanding of real-world phenomena including issues of fairness and justice (e.g., Is our water safe? Is this sharing plan fair? How do we know this claim is true?). Modeling is a cyclical process using mathematics to make-sense of and analyze real-world situations through problem posing, decision making, creating, revising, and generalizing. Mathematical modeling is a Common Core high school content standard, a K-12 mathematics practice standard, and measured on state, national, and international assessments (e.g., Smarter Balanced Assessment, PISA). Mathematical modeling and the connections to cultural and community contexts have been underemphasized in mathematics teacher education (pre-service and in-service). Research has shown that mathematical modeling broadens student access to and engagement with rigorous mathematics, while also recognizing and affirming various mathematical strengths of students. Thus, it makes sense to integrate mathematical modeling throughout K-12 education to help provide a strong foundation for mathematical advancement and to take action to improve our world.

In this session, we will share results and lessons learned from a three-year National Science Foundation project that focused on teaching and learning mathematical modeling in grades 3-5 specifically focused on cultural and community contexts. By engaging with community-based modeling tasks, mathematizing-the-world routines, and student work generated from our project, we will explore how mathematical modeling can help make mathematics rich, rigorous, and relevant for children and youth. We will also share researcher, teacher and instructional coach insights about the supports and challenges of integrating mathematical modeling into instructional practice. Issues of building and district support will be discussed. Professional development resources for culturally responsive and community-based modeling activities will be provided. Our session will conclude with an audience invitation to consider their roles in supporting mathematical modeling as an equity lever for K-12 mathematics.

CONCURRENT 4

Mathematizing the World with Mathematical Modeling K-5: Professional Learning with Elementary Teachers about Mathematical Modeling

Leading session with Erin Turner.

Mathematical Modeling is a cyclical process using mathematics to make-sense of and analyze real-world situations through problem posing, decision making, creating, revising, and generalizing. Mathematical modeling leverages student understanding of real-world phenomena including family, community and cultural practices they engage with or can imagine in their daily life. Research has shown that mathematical modeling broadens student access to and engagement with rigorous mathematics, while also affirming various mathematical strengths. Yet, there is limited research on what math modeling looks like in the elementary grades.

In this interactive session, we will share professional development tools and resources developed from a three-year National Science Foundation research project focused on teaching and learning mathematical modeling with cultural and community contexts, in grades 3-5. We will discuss professional learning supports for elementary teachers to teach mathematical modeling that intentionally connects to students' funds of knowledge and lived experiences. We will show examples of project and teacher generated math modeling tasks, samples of student work, and tools for modifying curriculum to be more modeling friendly. Our session will help make the case that mathematical modeling is an equity lever in K-12 mathematics education and is especially powerful for diverse elementary classrooms. Even though our examples will come from grades 3-5, we will discuss the application of the ideas of this session to all grade levels.

about Deborah Lowenberg Ball

Deborah Loewenberg Ball is the William H. Payne Collegiate Professor of education at the University of Michigan, an Arthur F. Thurnau Professor, and the director of TeachingWorks. She taught elementary school for over 15 years, and continues to teach mathematics to elementary students every summer. Deborah studies the practice of teaching as the active work of building relationships with children. She uses elementary mathematics as a context for investigating the challenges of helping children develop agency and understanding, and for leveraging the power of teaching to disrupt racism and inequity. Deborah is an expert on teacher education, and her current work centers on improving the quality of beginning teaching, particularly for children of color and low-income children. She has been elected to the American Academy of Arts and Sciences and the National Academy of Education, and is a fellow of the American Mathematical Society and the American Educational Research Association.

OPENING KEYNOTE

Mathematics Teaching and the Pursuit of Justice

Leading session with Imani Masters Goffney.

Practices that permeate mathematics classrooms have persistently contributed to the reproduction of patterns of racism and oppression. Rooted in larger systems and structured, some of these practices (e.g., insisting that young children sit still and straight up, excluding children who are interpreted as having "behavior problems") are visibly harmful to students who are members of historically marginalized groups, while others, thought to be "best practices" (e.g., some taken-for-granted discussion norms) yet are nonetheless causing harm. Many mathematics educators have worked assiduously to develop alternative practices and approaches that aim to disrupt these patterns of racism and oppression. We argue that these efforts are crucial to change practice and make classrooms places where



children thrive, and that they depend on closely attending to and supporting the discretionary work of teaching and the development of teachers who are also steeped in the oppressive patterns of our society. Moreover, we claim that mathematics classrooms, re-envisioned and practiced in anti-racist ways, have a special role to play in the struggle for justice, more broadly. The session will examine concrete examples of this work and discuss applicability of these examples to all preK-12 grade levels.

about Virginia Bastable

Virginia Bastable recently retired from the Mathematics Leadership Program (MLP) of Mount Holyoke College. MLP conducts a set of coordinated professional development seminars examining the learning and teaching of mathematics each summer, offers academic year on-line courses for math coaches and classroom teachers, provides math consulting and programs to school systems, and offers a Masters of Arts in Mathematics Teaching (MAMT) for practicing teachers and teacher-leaders. With Deborah Schifter and Susan Jo Russell of TERC, Virginia is an author of the *Developing Mathematical Ideas* (DMI) professional development curriculum published by NCTM and two books on mathematical reasoning about the operations published by Heinemann: *Connecting Arithmetic to Algebra*, and *But Why Does it Work: Mathematical Argument in the Elementary Classroom* (BWDIW). She also contributed to the third edition of *Investigations in Number, Data and Space*. Virginia is currently working with teachers and administrators of the Los Angeles Unified School District through a project with the UCLA Math Project to examine how students develop ideas of algebraic thinking in grades 4 through Algebra I. She facilitates the online course, *Developing Mathematical Reasoning*, as part of the MAMT program and offers workshops based on the DMI and BWDIW materials.

CONCURRENT 3 AND 7

Redefining Math Instruction: Raising Issues of Identity, Coherence, and Assets Within an Urban School District

Leading session with Kristine Ho.

Helping teachers come to see their students as capable mathematical thinkers requires both mathematical and pedagogical knowledge. Many teachers have had limited opportunities to experience mathematics as a set of coherent ideas which develop over time. This is limiting when they need to seek the potentially rich mathematics in partially correct or even incorrect answers. Making connections across the grade levels is necessary if teachers are to honor the contributions of all students. Current schooling structures often isolate teacher collaboration to peers at their own grade level, therefore, opportunities to see the relationship between the mathematical ideas they are responsible for teaching and the content in previous or latter grades is constrained.

Pedagogical approaches commonly used in one level (elementary, middle, and secondary) are often different from those at another, and the limited vertical articulation can create barriers for teachers to share these practices. For teachers to be able to build on previous student success and to recognize the contributions of all students, they need a wide range of understanding of both mathematics and of varied instructional approaches.

A partnership between the Los Angeles Unified School District (LAUSD) Local District West and the University of California at Los Angeles Math Project (UCLAMP) was formed to create professional development opportunities to support teachers and administrators of grades 4 through Algebra I to come to see each other as colleagues working together to support the development of every student's math knowledge, voice and identity.



In the partnership, educators:

- expand their own mathematical knowledge
- deepen their abilities to solicit and use student thinking
- recognize and support the brilliance of all students
- create classroom communities which support diverse and varied participation
- examine, analyze, and, eventually, adopt a set of principled ideas about student learning

While these objectives describe the partnership between LAUSD and the UCLA Math Project, they will also serve as the basis for this session. In a microcosm, we will be actively participating in the same work as the partnership teachers and administrators. The session will include work with partnership tools such as the student work analysis form, will provide time to discuss the Principled Ideas which underlie the work, and will offer details of the different professional development structures of the partnership for both teachers and administrators.

At the core of this partnership are the Principled Ideas of UCLAMP. During this session we will explore how these are relevant and applicable to issues of equity and access of transformative mathematics for ALL students. Throughout the session participants will have the opportunity to consider the implications of the UCLAMP Principled Ideas and the project's PD structures for their own instructional contexts.

about **Robert Q. Berry III**

Robert Q. Berry III is president of the National Council of Teachers of Mathematics (NCTM), a 50,000-member international mathematics education organization. Robert is a Professor in the Curry School of Education at the University of Virginia. Robert teaches mathematics methods courses in the teacher education program as well as graduate level mathematics education courses and courses for in-service teachers seeking a mathematics specialist endorsement. He is a former middle school teacher and was twice named Teacher of the Year in Virginia. Equity issues in mathematics education are central to Robert's research efforts within four related areas: (a) understanding Black children's mathematics experiences (mathematical identities and agency); (b) measuring standards-based mathematics teaching practices; (c) unpacking equitable mathematics teaching and learning; and (d) exploring interactions between technology and mathematics education. Robert has collaborated on the Children's Engineering Initiative in the Curry School of Education to use digital fabrication to incorporate engineering design principles into mathematics education. His most recent work has focused on using qualitative meta-synthesis as an approach to understand the mathematics experiences of learners. He has published nearly 100 articles, book chapters, and proceedings. Robert served on the Board of Directors of the National Council of Teachers of Mathematics 2011–2014 and is a two-time recipient of NCTM's Linking Research and Practice Publication Award. He was recognized as the 2011 Mathematics Educator of the Year by the Virginia Council of Teachers of Mathematics (VCTM), and received the University of Virginia's All University Teaching Award in 2011. Robert is a member of Teachers Development Group Board of Directors.

CONCURRENT 3 AND 4

How Do We Teachers Teach Math to Black Kids? My Response

"What can our schools, districts, or teachers do to impact the mathematics achievement of Black learners?" I am often asked some derivation of this question by educators who are looking to support Black learners in mathematics. Given that much of my work has focused on the mathematics experiences of Black learners, I expect such questions. In this session, I will unpack this question, provide resources, and engage participants from across the preK-12 spectrum in critical conversations.



CLOSING KEYNOTE

Unpacking Culturally Relevant Pedagogy and Culturally Responsive Teaching in Mathematics: Connecting Theory to Practice

Mathematics education has benefited from teaching and research using the tenets of Culturally Relevant Pedagogy (CRP) and Culturally Responsive Teaching (CRT), yet there is little understanding about the impact of these tenets on mathematics teaching, and CRP and CRT are frameworks that respond to traditional mathematics teaching practices by empowering learners to see the multiple purposes for learning mathematics, helping learners appreciate why mathematics is important in their lives, and allowing learners to believe they can succeed in mathematics. This session focuses on Gloria Ladson-Billings and Geneva Gay theoretical frameworks as a way of focusing on teaching practices associated with both CRP and CRT.

about **Kristen Bieda**

Kristen Bieda is an Associate Professor of Teacher Education and Mathematics Education at Michigan State University. A former middle school, high school, and community college teacher, She completed her Ph.D in Curriculum and Instruction from the University of Wisconsin-Madison in 2008. She currently serves as the Associate Director of Mathematics for the CREATE for STEM Institute at Michigan State, and is the subject area leader for the secondary mathematics teacher preparation program. Kristen's research aims to understand more about the engagement of secondary students (grades 9-12) in meaningful mathematical practices, including reasoning and proving. Her work also investigates innovative designs for field experiences to better prepare novice teachers for ambitious teaching practice. Her research has been featured in journals such as *Journal for Research in Mathematics Education*, *Journal of Teacher Education*, and *ZDM: An International Journal of Mathematics Education*. Her 2010 publication in JRME was awarded the AERA SIG-RME Early Career Publication Award in 2014. She is currently PI of a collaborative, multi-institutional NSF IUSE grant focused on investigating the impact of a university-based field experience for prospective teachers. In addition, she is currently co-PI for two NSF DRK-12 grants focused on the development of a digital middle grades curriculum that supports productive disciplinary engagement. Prior funding includes a large-scale study of the influence of social networks on elementary teachers' mathematics instruction.

CONCURRENT 3 AND 7

Productive Disciplinary Engagement: A Framework to Support Equitable Opportunities to Learn Challenging Mathematics

Productive disciplinary engagement (PDE; Engle & Conant, 2002) is defined as the extent to which students' classroom experiences embody characteristics of disciplinary practice. The four principles of classrooms that support PDE are: problematizing, authority, accountability, and resources. Problematizing happens when students grapple with mathematical uncertainties that they face some measure of challenge to resolve. Authority represents the extent to which students exhibit agency in addressing mathematical uncertainties. The classroom discourse contributes to supporting students' agency to solve challenging problems and building their identities as mathematical authorities. When the teacher or students press a student to explain their thinking or justify their mathematical claim, the discourse reinforces accountability as a classroom norm. Finally, students' access to resources, including curriculum materials, digital tools, and even others' in-the-moment thinking, plays a key role in supporting PDE during a class. PDE offers a way to consider students' classroom experiences that integrates attention to the cognitive demand of students' mathematical work along with attention to how students are expressing agency and being held accountable for rigorous work in the classroom, yet its current use to support teachers' reflection on their practice in mathematics classrooms has been limited.



Much of the existing work using PDE as a lens on classroom learning focuses on how teacher actions support or inhibit the four principles of classrooms that embody PDE. In this session, you will learn about a new framework that describes the principles of classrooms that embody PDE in terms of what students are doing and saying as indicative of these principles. The framework was developed using video-recordings of middle grades mathematics classrooms focused on the use of a digital curriculum with innovative supports for small group, collaborative work on open problems. For each of the four principles, the framework articulates observable criteria and distinguishes these criteria into categories of high, medium, and low PDE. This framework holds promise for use in professional development, specifically to help teachers notice specific behaviors that reveal the extent to which students' work reflects productive disciplinary engagement. We will discuss, in particular, how the criteria specified for authority and accountability could inform assessments of students' opportunities to learn in highly diverse classroom settings.

During the session, participants will receive copies of the framework, learn about its development, and take a deep dive into understanding each criteria. We will look at examples of classrooms where students' engagement models high, medium, and low PDE and discuss how resources such as digitally-based curriculum, one-to-one technology models, and paper-based curriculum materials influence the quality of PDE in classrooms. We will collectively discuss possibilities for using the framework in PD settings with preK-12 teachers, such as incorporating the framework into teacher video clubs and supporting grade level teams to engage in collaborative inquiry into the emergence of PDE in pair or small group work.

about **Hilda Borko**

Hilda Borko is the Charles E. Ducommun Professor of Education in the Stanford Graduate School of Education, where she serves as Chair of the Curriculum and Teacher Education program area. Her research explores teacher cognition and instructional practices, the process of learning to teach, and the impact of teacher professional development programs on teachers and students. With colleagues Karen Koellner and Jennifer Jacobs, Hilda developed the Problem-Solving Cycle (PSC) model of mathematics PD and Mathematics Leadership Preparation (MLP) model for preparing PSC facilitators. Their book, *Mathematics Professional Development: Improving Teaching Using the Problem-Solving Cycle and Leadership Preparation Models* (Borko, Jacobs, Koellner, & Swackhamer, 2015), written for an audience of PD leaders, describes the two models, summarizes key research findings, provides detailed examples of workshop activities, and shares lessons learned. Hilda's current NSF-funded project with Janet Carlson, *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 the two models and build district capacity to implement the PSC at school sites. She is also a partner in the NSF-funded Practical Measures project. Dr. Borko served as President of the American Educational Research Association. She is a member of the National Academy of Education, and received the 2014 Excellence in Scholarship in Mathematics Teacher Education Award, AMTE.

CONCURRENT 2 AND 3

Using Data from "Practical Measures" to Reflect on and Improve Classroom Practice and Professional Learning
Leading session with Kara Jackson, Anita Lenges, and Michael Jarry-Shore.

Instructional leaders who plan and facilitate professional learning (e.g., coaching, workshops, collaborative experiences) often have limited ways to get systematic, targeted, ongoing feedback about teachers' current instructional practices or teachers' perceptions of professional learning. In this session, we will introduce a system of "practical measures," or tools, that are intended to provide leaders (and teachers) with frequent feedback that enables them to assess and adjust their practice. One set of tools (classroom practical measures) are intended for



leaders to use in their work with teachers to reflect on and set goals for instructional improvement. The second set of tools (professional learning practical measures) are intended to support leaders to reflect on and set improvement goals for the design and facilitation of professional learning. The measures have been designed in partnership with multiple districts who share ambitious goals for teacher practice and student learning in middle-grades mathematics. Both sets of measures are easy to administer, and the resulting data is easily analyzed and acted upon. Importantly, these tools are intended to support improvement, not to be evaluative.

In the session, we will first provide background on “practical measures,” and what motivated partnerships between researchers and district math leaders to design a system of measures. Second, we will introduce classroom practical measures, with an explicit emphasis on how the measures can surface issues of equity. The launch, small-group discussion, and whole-class discussion measures each take the form of a student survey that elicit students’ perspectives of instruction and can be administered in 1-3 minutes. Associated data representations are made available via a dashboard interface that displays the resulting data in a variety of ways intended to support practitioners to track and set goals for improvement. Participants will work collaboratively to make sense of the classroom measures and to examine some sample data and representations. Third, we will introduce professional learning practical measures, which are currently in development. At present, the measures focus on whether a culture has been established in which all teachers willingly share and press on each other’s ideas; the nature of teachers’ pedagogical reasoning; teachers’ perceptions of the relevance of the activity; and teachers’ experiences of making practice public. We will invite participants to think with us about how we might refine the professional learning measures to capture what leaders view as important. The session will close with time for participants to consider how they might want to embed the measures in their ongoing efforts to improve teaching and learning. While examples come from work with teachers at grades 6-8, applicability to professional learning across the preK-12 spectrum will be discussed.

about Megan Brunner

Megan Brunner is a mathematics education doctoral candidate in the STEM Education program at Oregon State University. Her research examines equitable mathematics teaching from a systems perspective in secondary education, focusing on the instructional tools and practices teachers oriented towards equity employ in their classrooms. Megan works with Elyssa Stoddard and Rebekah Elliott in a research-practice project focused on the ways that math teachers and leaders across districts design, refine, and enact instructional tools to attend to local problems of practice. Megan teaches math each summer to rising eighth-grade students at Aim High, an educational, non-profit, program in San Francisco, California. She also teaches secondary mathematics methods and curriculum design courses for teacher candidates at Oregon State University.

CONCURRENT 4 AND 7

Mathematical Modeling Instructional Tools Fostering Student Agency and Equity

Leading session with Elyssa Stoddard and Rebekah Elliott.

The Common Core State Standards and new curriculum have increased attention on mathematical modeling for K12 students to critique their world, see the wonder and relevance of mathematics, and explore mathematics useful for career and post-secondary aspirations. State education leaders are supporting aligning mathematics pathways that emphasize the power and opportunity that mathematical modeling may play in mathematics. In Oregon, teachers have worked to incorporate mathematical modeling in their classrooms, responding to NCTM’s Catalyzing Change in High School Mathematics. These efforts reveal a need to more clearly explicate the interactions among equity, discourse, and mathematical modeling and to design tools and practices to support students’ agency in classrooms.



Through our work with leaders, we have developed instructional tools that support dialogue on equity, mathematical discourse, and modeling to support teachers and leaders to engage in collaborative inquiry on instructional practice and to build a shared vision for equity and mathematical modeling in their schools. These tools elaborate on what a mathematical modeling cycle entails for teachers and students and articulate key ideas about equity, discourse, and modeling in written narratives for teachers, connecting educational research to classroom practice. In this session, we investigate this suite of instructional tools to take up mathematical modeling, discourse, and equity. We do so by considering how leaders may support teachers to engage in deep discussion of these ideas and collaboratively consider how these tools are useful for improving mathematics instruction.

This session attends to two questions in support of teacher and leaders' learning. First, how could we use observation-based rubrics to support mathematics teachers' knowledge and skill with mathematical modeling? Second, how could teachers and students use mathematical modeling as an opportunity to cultivate agency, competence, and identity that fosters greater equitable opportunities for student participation? In this session, we build knowledge and insights on what mathematical modeling looks and sounds like in secondary mathematics classrooms where students have opportunities to develop new mathematical knowledge. We explore these questions through solving and investigating a mathematical modeling task relevant to secondary mathematics and exploring mathematical modeling via classroom artifacts. Although the task we explore is situated in secondary mathematics, K-12 leaders will investigate the two rubrics and practice briefs to further elaborate practices that support K-12 teachers and students to engage in equitable and robust mathematics. Our goals for this session are for leaders and teachers to develop understandings of how mathematical modeling instruction can provide equitable opportunities for student engagement, consider how to introduce mathematical modeling and engage in it with teachers and students, and leave with instructional tools that can guide and support mathematical modeling instruction as equity and mathematics leaders.

about Heather Bussmann

Heather Bussmann is a facilitator of math education at Summit High School in Bend, OR. She started her career as a Domestic Violence and Sexual Assault counselor where she ignited her passion for education by teaching an eight-week violence prevention program in the local school districts of Siskiyou County, CA. She then relocated and decided to pursue a career in education, receiving a Bachelor of Science in Mathematics from the University of Oregon and a Masters of Arts in Teaching from George Fox University. She has been facilitating mathematics education for 14 years split between Crook County High School in Prineville, OR and Summit High School in the Bend-La Pine School District. Through TDG Math Studio work and other professional development opportunities she continues to grow and balance the ever-pulling swing between conceptual understanding and procedural fluency. She is particularly fond of Grace Kelemanik, Amy Lucenta, and Susan Janssen Creighton's *Routines for Reasoning*. Their work has been an inspiration in developing routines to support students in unpacking the modeling process and what is required for students and teachers to engage in Math Practice 4: Model with Mathematics.

CONCURRENT 2

Teacher Leader Collaborations to Design, Enact and Refine Mathematical Modeling Instructional Routines
Leading session with Jackie Greenwood and Rebekah Elliott.

Classroom mathematical modeling demands that teachers and students renegotiate the mathematical work they do together and how that work gets done. Many of the mathematical modeling materials for teachers provide insights on modeling as a cycle of activity integrating real-world and mathematical situations, promoting problem formation, mathematizing problems, and coordinating a mathematical model and justification to make meaning within the real



world. Although seemingly well defined, this cycle doesn't help us unpack the multi-faceted decision making that happens within each phase and across phases of the cycle. Modeling resources such as tasks and professional development supports provide an image of mathematical activity; yet, they don't provide insights on effective instruction of mathematical modeling and how to improve it.

The presenters in this session have worked over the past two years, to understand modeling instruction and ways to support teachers and students to successfully navigate modeling tasks. To this end, they have designed, enacted, and refined, what colleagues Grace Kelemanik and Amy Lucenta call, mathematics routines for reasoning. In this session, we share modeling routines that align with specific mathematical goals and are repeatable structures for supporting students to engage in elements of the modeling cycle. The routines highlight the work of making and defining assumptions and variables in the problem formation phase of modeling and critiquing and iterating models to make meaning within the context of the task. We fondly call these two routines, Donkey U Me and Is It Good Enough. These routines focus on elements of the modeling cycle, without taking on the whole cycle, with the intention to support each and every student in the highly challenging mathematical work of defining and critiquing, essential to mathematical modeling. We have found that although these routines were developed for secondary mathematics modeling, they can be adapted to a variety of mathematical tasks and across K-12 content to leverage defining and critiquing as mathematical practices.

In this session, we will examine the two mathematical modeling routines, Donkey U Me and Is It Good Enough, with mathematics tasks accessible to a broad preK-12 audience. Session presenters will rehearse using the routines with participants and discuss the goals for each element of the routines. From this experience, we will talk about teacher learning and collaboratively consider how leaders may support teachers using the routines to navigate the complexity of mathematical modeling. We conclude with time for participants to consider and share how routines can be taken up to support key features of mathematical modeling inside of curricular resources, gain insights from presenters who have used these routines across a variety of tasks, and talk with colleagues as leaders of equity and mathematics to advance mathematical modeling.

about **Marta Civil**

Marta Civil is a Professor of Mathematics Education and the Roy F. Graesser Chair in the Department of Mathematics at The University of Arizona. She has over 25 years of experience working with teachers, children, and families in mathematics, primarily in Mexican American communities. Her research looks at cultural, social, and language aspects in the teaching and learning of mathematics; participation in the mathematics classroom; connections between in-school and out-of-school mathematics; and parental engagement in mathematics. She has led several funded projects working with children, parents, and teachers, with a focus on developing culturally responsive learning environments in mathematics education. Her most recent work is a K-3 parental engagement mathematics project aimed at developing a two-way dialogue between home and school. Currently she is also exploring how to apply lessons learned from her work in equity in K-12 settings to undergraduate / entry level mathematics teaching and learning.

CONCURRENT 1 AND 7

New Possibilities for Parents as Partners in the Mathematics Education of Bilingual Learners

Leading session with Linda Griffin.

Parents of Bilingual learners are a valuable and often untapped resource for enhancing mathematics outcomes in schools. This session will draw on several mathematics education projects related to working with parents / families



mostly of Mexican origin and Spanish speaking. The principles and activities can be adapted to different groups of parents. This work is based on the idea of parents as intellectual resources (Civil & Andrade, 2003), which sees parents as experts with knowledge and experiences they can contribute to towards students' mathematics education. We will share an approach to parental engagement in mathematics that starts with "parents as parents" but also includes "parents as learners", "parents as facilitators", and "parents as leaders."

We will share activities aimed at:

- a) engaging parents in mathematics explorations (family mathematics workshops as well as Math For Parents courses)
- b) engaging teachers to learn from parents' / families' uses of and experiences with mathematics
- c) establishing a dialogue about mathematics between parents and teachers
- d) facilitating a parents' visit to a mathematics classroom
- e) supporting teachers to view parents as intellectual resources and partners for student success.

We will use a combination of hands-on-activities and videoclips to illustrate these different components. We will draw on lessons learned from listening to parents to discuss implications for teaching of mathematics, particularly in diverse settings with bilingual / multilingual students. Our goal is to highlight the importance of paying attention to linguistic and cultural resources as well as to parents' perceptions about the teaching and learning of mathematics. We will provide suggestions for leaders (e.g., teacher leaders, mathematics coaches, administrators) to engage and support preK-10 teachers in their work with parents.

Civil, M., & Andrade, R. (2003). Collaborative practice with parents: The role of the researcher as mediator. In A. Peter-Koop, V. Santos-Wagner, C. Breen, & A. Begg (Eds.), *Collaboration in teacher education: Examples from the context of mathematics education* (pp. 153-168). Boston, MA: Kluwer.

about **Linda Ruiz Davenport**

Linda Ruiz Davenport is the Director of K-12 Mathematics for the Boston Public School (BPS) and is responsible for supporting math teaching and learning across the district. This includes ensuring that all teachers have access to high-quality standards-aligned math curriculum materials, supporting the use of formative assessment strategies that uncover student thinking, designing professional development programs for teachers, teacher leaders, and principals to support their ongoing learning, and providing school-based support for math teaching and learning in selected contexts. In the past, the BPS has been recognized for gains in math performance on our state assessment and the NAEP. Prior to taking a position with the BPS, Davenport was a middle school and high school math teacher in a district serving a diverse population of students, a Math Specialist for a Bilingual Education Service Center, an Assistant Professor of Math Education at Portland State University, and a project director at the Education Development Center. She currently serves on several advisory boards that focus on math teacher learning, recently was member of the development panel for the 2025 NAEP Mathematics Framework where issues of equity and access were central to the work, and is currently on the NCTM Board of Directors.



CONCURRENT 1 AND 4

Building School Capacity for Equitable Teaching Practices through Math Teacher Leadership

Leading session with Ondrea Johnston.

In this session, we share our current successes and challenges collaborating with approximately 100 math teacher leaders representing elementary, middle, and high school grade bands as we explore practices that promote equitable and high-quality math instruction. This work builds on prior math teacher leadership work using NCTM's *Principles to Action*, *The Impact of Identity in K-8 Mathematics*, *Taking Action: Implementing Effective Mathematics Teaching Practices*, *A Fresh Look at Formative Assessment in Mathematics Teaching*, and the NCSM/TODOS position paper *Mathematics Education Through the Lens of Social Justice*—all of which have helped raise awareness and shift math teaching practice.

Despite this rich and engaging work, there are challenges, particularly given the district's assessment culture focusing on frequent periods of testing and reteaching, levels of accountability based on test results, and test-prep strategies that many teachers embrace as a result of these pressures. This is further complicated by our limited access to school administrators who are held even more accountable to test results. In this year's work, we are being more explicit with our math teacher leaders about the instructional practices that lead to more equitable and high-quality math instruction we expect them to use in their own classrooms using *5 Practices in Practice* (2019; Peg Smith et al.). In addition, we are being more explicit about expectations for how math teacher leaders collaborate with colleagues to support their use of these instructional practices in their own classrooms. Finally, we are being more explicit about expectations for their ongoing collaborations with school administrators to develop plans that support collaboration with colleagues in ways that build a school commitment to these instructional practices. We will share how this work is unfolding in schools, including any evidence we have about how the teaching practices of math teacher leaders seem to be shifting, how their work with colleagues is unfolding, and the extent to which school administrators are becoming partners in this work.

As we share this work, we also make time to hear from participants about the math teacher leadership work they are supporting in their schools and districts, including how their work is structured, successes and challenges, and the structures they leverage as they work to strengthen math teaching and learning. By the end of the session, we hope to identify a range of pathways forward as we all work to build school capacity for equitable teaching practices through math teacher leadership.

about **Jill Neumayer DePiper**

Jill Neumayer DePiper is a Research Scientist at Education Development Center, and she researches mathematics learning and teaching, with focus on equity and broadening participation. She takes a lead role on projects designing and studying professional development and instructional materials for mathematics teachers with students who are emergent multilinguals (EMs) in their classes, including Visual Access to Mathematics professional development program and the Analyzing Diagrams: Support for English Learners instructional materials and research project. She also supports continuous improvement cycles in school divisions in Virginia. In previous work, Neumayer DePiper designed and created materials for coaches to use with middle-grades mathematics teachers to improve teacher knowledge about how to support problem-solving and student communication. This research and related teacher professional development has been published as the book, *Mathematical Thinking and Communication: Access for English Learners*. Before joining EDC, Neumayer DePiper served as a researcher and instructor in the Center for Mathematics Education at the University of Maryland, College Park. She also has published on mathematics teacher



identity and relationships between teacher beliefs and teacher knowledge. She has a PhD in Curriculum and Instruction from the University of Maryland.

CONCURRENT 5 AND 6

Facilitating Mathematical Practices through Student-teacher Relationships and Diagrams: Focusing on Students who are English Learners

Leading session with Johannah Nikula.

All students, including students who are emergent multilingual (EMs) (frequently identified by their schools as English learners), need cognitively demanding mathematical learning experiences that emphasize mathematical practices. However, EMs generally have fewer opportunities for classroom participation and mathematical communication than their peers. Integrating diagram use and language production strategies with challenging mathematics tasks promotes EMs' mathematical reasoning and positions EMs as competent doers of mathematics. In this session, participants will learn to use diagrams and language strategies to facilitate EMs' agency in mathematics and participation in mathematical talk. Participants will also examine middle grades student work to explore the ways that diagramming and language strategies can support EMs and will provide the backdrop for consideration of how to support teachers.

Furthermore, to provide the optimum learning experience, teachers must also understand EMs' backgrounds, motivations, and experiences; that is, meeting language needs and facilitating rigorous mathematics experience are essential but not sufficient. Therefore, we will examine the Establish-Maintain-Restore (EMR) framework (Cook et al., 2018) for building student-teacher relationships in mathematics. Teachers' relationships with their students affect student achievement and participation (e.g., Xu & Qi, 2019). We have adapted the EMR framework to make it specific to the work in the mathematics classroom with EMs. This framework focuses on establishing strong relationships with students, maintaining those relationships, and being purposeful about restoring relationships when necessary. We will explore practical strategies for developing student-teacher relationships while facilitating EM engagement in mathematical practices. For example, we'll discuss how teacher use of open-ended mathematical questions with EMs promotes student engagement and affirms the mathematical contributions of the student. Other student-teacher relationship strategies that we will discuss in the context of mathematics include teacher-student interviews and family outreach and communication that focuses on mathematics.

It is critical to tie the work of diagram use and other supports for EMs to specific mathematical content. During this session, we will explore these ideas in the context of middle grades fraction operations and proportional reasoning content--mathematical content that is key to students' mathematical trajectory—but strategies that will be explored during the session can be applied across K-12 and we will support participants to make these connections. Session participants will examine strategies for building stronger student-teacher relationships with EMs in the context of mathematics lessons. Throughout the session we will provide opportunity for planning and reflection on how to implement supports in participants' own preK-12 contexts for mathematics teachers of EMs to use diagrams, integrate language strategies, and build student-teacher relationships.

about **Rebekah Elliott**

Rebekah Elliott is an associate professor of mathematics education at Oregon State University (OSU). Currently, she is working in a research-practice partnership with colleagues, Megan Brunner, Elyssa Stoddard, and district leaders to investigate how districts design, enact and adapt instructional tools as resources inside their curriculum. She also is working on a Google-funded project examining how computational thinking connects to mathematical practices in teacher education with OSU colleagues in computer science and mathematics. Her research interests are two-fold, focusing on ways in which teachers learn ambitious mathematics instruction in teacher education and



professional learning and examining how educational systems support and hinder equitable and just instructional transformation.

CONCURRENT 4 AND 7

Mathematical Modeling Instructional Tools Fostering Student Agency and Equity

Leading session with Megan Brunner and Elyssa Stoddard.

The Common Core State Standards and new curriculum have increased attention on mathematical modeling for K12 students to critique their world, see the wonder and relevance of mathematics, and explore mathematics useful for career and post-secondary aspirations. State education leaders are supporting aligning mathematics pathways that emphasize the power and opportunity that mathematical modeling may play in mathematics. In Oregon, teachers have worked to incorporate mathematical modeling in their classrooms, responding to NCTM's Catalyzing Change in High School Mathematics. These efforts reveal a need to more clearly explicate the interactions among equity, discourse, and mathematical modeling and to design tools and practices to support students' agency in classrooms.

Through our work with leaders, we have developed instructional tools that support dialogue on equity, mathematical discourse, and modeling to support teachers and leaders to engage in collaborative inquiry on instructional practice and to build a shared vision for equity and mathematical modeling in their schools. These tools elaborate on what a mathematical modeling cycle entails for teachers and students and articulate key ideas about equity, discourse, and modeling in written narratives for teachers, connecting educational research to classroom practice. In this session, we investigate this suite of instructional tools to take up mathematical modeling, discourse, and equity. We do so by considering how leaders may support teachers to engage in deep discussion of these ideas and collaboratively consider how these tools are useful for improving mathematics instruction.

This session attends to two questions in support of teacher and leaders' learning. First, how could we use observation-based rubrics to support mathematics teachers' knowledge and skill with mathematical modeling? Second, how could teachers and students use mathematical modeling as an opportunity to cultivate agency, competence, and identity that fosters greater equitable opportunities for student participation? In this session, we build knowledge and insights on what mathematical modeling looks and sounds like in secondary mathematics classrooms where students have opportunities to develop new mathematical knowledge. We explore these questions through solving and investigating a mathematical modeling task relevant to secondary mathematics and exploring mathematical modeling via classroom artifacts. Although the task we explore is situated in secondary mathematics, K-12 leaders will investigate the two rubrics and practice briefs to further elaborate practices that support K-12 teachers and students to engage in equitable and robust mathematics. Our goals for this session are for leaders and teachers to develop understandings of how mathematical modeling instruction can provide equitable opportunities for student engagement, consider how to introduce mathematical modeling and engage in it with teachers and students, and leave with instructional tools that can guide and support mathematical modeling instruction as equity and mathematics leaders.

CONCURRENT 2

Teacher Leader Collaborations to Design, Enact and Refine Mathematical Modeling Instructional Routines

Leading session with Jackie Greenwood and Heather Bussmann.

Classroom mathematical modeling demands that teachers and students renegotiate the mathematical work they do together and how that work gets done. Many of the mathematical modeling materials for teachers provide insights on modeling as a cycle of activity integrating real-world and mathematical situations, promoting problem



formation, mathematizing problems, and coordinating a mathematical model and justification to make meaning within the real world. Although seemingly well defined, this cycle doesn't help us unpack the multi-faceted decision making that happens within each phase and across phases of the cycle. Modeling resources such as tasks and professional development supports provide an image of mathematical activity; yet, they don't provide insights on effective instruction of mathematical modeling and how to improve it.

The presenters in this session have worked over the past two years, to understand modeling instruction and ways to support teachers and students to successfully navigate modeling tasks. To this end, they have designed, enacted, and refined, what colleagues Grace Kelemanik and Amy Lucenta call, mathematics routines for reasoning. In this session, we share modeling routines that align with specific mathematical goals and are repeatable structures for supporting students to engage in elements of the modeling cycle. The routines highlight the work of making and defining assumptions and variables in the problem formation phase of modeling and critiquing and iterating models to make meaning within the context of the task. We fondly call these two routines, Donkey U Me and Is It Good Enough. These routines focus on elements of the modeling cycle, without taking on the whole cycle, with the intention to support each and every student in the highly challenging mathematical work of defining and critiquing, essential to mathematical modeling. We have found that although these routines were developed for secondary mathematics modeling, they can be adapted to a variety of mathematical tasks and across K-12 content to leverage defining and critiquing as mathematical practices.

In this session, we will examine the two mathematical modeling routines, Donkey U Me and Is It Good Enough, with mathematics tasks accessible to a broad preK-12 audience. Session presenters will rehearse using the routines with participants and discuss the goals for each element of the routines. From this experience, we will talk about teacher learning and collaboratively consider how leaders may support teachers using the routines to navigate the complexity of mathematical modeling. We conclude with time for participants to consider and share how routines can be taken up to support key features of mathematical modeling inside of curricular resources, gain insights from presenters who have used these routines across a variety of tasks, and talk with colleagues as leaders of equity and mathematics to advance mathematical modeling.

about Mike Flynn

Mike Flynn is the director of Mathematics Leadership Programs at Mount Holyoke College, where he runs the Master of Arts in Teaching Mathematics program and leads a wide variety of professional learning opportunities for teachers, teacher-leaders, coaches, administrators, and staff-developers. Mike travels across the country and around the world to work with schools, districts, and organization that are interested in advancing the learning and teaching of mathematics. He also speaks at major math and education conferences. Mike is the author of *Beyond Answers: Exploring Mathematical Practices with Young Children* published by Stenhouse. This book is designed to support elementary teachers that are looking to shift their practice to engage their students in the real work of mathematics rather than just answer-getting. Prior to this work Mike taught second grade at the William E. Norris Elementary School in Southampton, MA for 14 years. He was named the Massachusetts Teacher of the Year in 2008 and was a 2010 recipient of the Presidential Award for Excellence in Mathematics Teaching. He tweets at @MikeFlynn55

Plenary B

Powerful Moments in Math Class: Redefining Mathematical Identities and Creating Positive Memorable Experiences for All Learners

We have all experienced defining moments in our lives. These were moments that shaped our identities, gave us a sense of status within certain communities, and put us on the path to work in mathematics education. As teachers and teacher leaders, we want our lessons and learning experiences to leave long-lasting impressions on those with



whom we work. We want to empower those with whom we work with a belief that they too are math capable. When we understand the psychology behind memories, learning, and identity, we can leverage that knowledge to design powerful moments for adults and students alike. According to Heath and Heath (2018) memorable positive experiences contain one or more of the following elements: elevation, insight, pride, and connection. We will explore each of these elements in depth through a mathematical lens and consider how to implement them in our work with students and/or adult learners. We will also consider how one's beliefs and mindset might influence who has access to these elements and how we can work toward more equitable experiences for all preK-12 students.

CONCURRENT 2

Turning Adversaries Into Allies: Building Community-Wide Support for Equitable Initiatives in Mathematics Education

Any initiative in mathematics education, whether classroom-based or state-wide, requires support from all stakeholders (students, parents, administrators, school board, etc.) involved. However, building and sustaining that support can be challenging, especially if there are pockets of skeptics actively working against your goals. For most parents, policymakers, and members of the general public, their understanding of what math is supposed to look like derives from their own experiences as students. Dan Lorte coined the phrase "apprenticeship of observation" to describe people's perceptions that they understand a teacher's job because they have had a lot of experience being in classrooms as students. As a result of this phenomenon, any form of teaching that looks different from what they experienced is called into question.

This session will provide preK-12 teachers, coaches, administrators, and other educational leaders with strategies and resources to help them build support and momentum within their communities for meaningful and equitable mathematics education for each and every student. This session will draw upon the work of Chip and Dan Heath and their SUCCESS framework, Robert Cialdi's six principles of influence, and Jonah Berger's STEPPS framework for building system-wide support. The session is designed to be interactive so participants have a chance to try some of the ideas and create plans to take back to their districts.

about Megan Franke

Megan Franke is a Professor of Education at UCLA. Megan's research focuses on understanding and supporting teacher learning for both preservice and inservice teachers. She studies how teachers making use of research-based information about the development of children's mathematical thinking support students to learn mathematics. She is particularly interested in how teaching mathematics with attention to students' mathematical thinking (Cognitively Guided Instruction) can challenge existing school structures and create opportunities for economically marginalized students and students of color to learn mathematics with understanding. She has been engaged in a series of studies with Dr. Noreen Webb, UCLA, that link classroom practice and student outcomes in elementary mathematics classrooms. In addition, she is studying with her Core Practice Consortium colleagues the impact of field-based methods for preservice teachers. She is a member of DREME (Development and Research in Early Mathematics Education) where she is studying pre-K-2 coherence and designing resources for early childhood teacher educators. She is currently partnering with LAUSD to support teachers in pre-K-5th grade across 120 elementary and preschools. Her research work to support teachers, schools and communities was recognized with the AERA Research into Practice Award and she was elected to the National Academy of Education.

CONCURRENT 4 AND 6

From Counting to Problem Solving: Challenging Linear Notions of Learning

Leading session with Angela Turrou.

Many educators are familiar with our “counting collections” work and its value in supporting children’s thinking and mathematical learning across PreK-5. Counting collections has been particularly powerful in challenging deficit views of children and highlighting the detailed mathematical understandings they bring to the classroom. Over the past many years, we have leveraged this counting work to focus specifically on connections between counting and problem solving.

This session will engage participants in detailing children’s mathematical thinking in a way that leverages students’ partial/emergent understandings while challenging conceptions of “mastery” of one mathematical idea before another. We will also address the power of “counting to problem solving” for teacher learning as a deepened understanding of children’s thinking in counting and the operations supports collaborative shifts in teaching practice based on what children know and can do. While video examples will be drawn primarily from PreK-I, we invite connections to supporting teachers at any grade level to deepen attention to the details of children’s mathematical thinking and the varied resources they bring to the classroom.

about Imani Masters Goffney

Imani Masters Goffney currently works as an Assistant Professor of Mathematics Education at the University of Maryland- College Park. She earned her MA in Curriculum Development and PhD in Mathematics Education and Teaching and Teacher Education both from the University of Michigan. Her research focuses on mathematics instruction and on interventions designed to improve its quality and effectiveness, especially for students not traditionally served well by our educational system. In particular, she studies the ways in which teachers use mathematical knowledge for teaching in equitable ways. Her research contributes to a growing body of work that strives to better understand the role of content knowledge for improving student achievement and expands an understanding of how issues of race, culture, and social class intersect with students’ opportunities for learning mathematics. She currently manages her own research projects with funding from NSF and private foundations. She recently co-edited a book entitled, *Re-humanizing Mathematics for Black, Indigenous, and Latinx Students* (2018). She is an active member in AERA, NCTM, and AMTE serving in leadership roles for each of these organizations.

OPENING KEYNOTE

Mathematics Teaching and the Pursuit of Justice

Leading session with Deborah Lowenberg Ball.

Practices that permeate mathematics classrooms have persistently contributed to the reproduction of patterns of racism and oppression. Rooted in larger systems and structured, some of these practices (e.g., insisting that young children sit still and straight up, excluding children who are interpreted as having “behavior problems”) are visibly harmful to students who are members of historically marginalized groups, while others, thought to be “best practices” (e.g., some taken-for-granted discussion norms) yet are nonetheless causing harm. Many mathematics educators have worked assiduously to develop alternative practices and approaches that aim to disrupt these patterns of racism and oppression. We argue that these efforts are crucial to change practice and make classrooms places where children thrive, and that they depend on closely attending to and supporting the discretionary work of teaching and the development of teachers who are also steeped in the oppressive patterns of our society. Moreover, we claim that mathematics classrooms, re-envisioned and practiced in anti-racist ways, have a special role to play in the struggle



for justice, more broadly. The session will examine concrete examples of this work and discuss applicability of these examples to all preK-12 grade levels.

CONCURRENT 3

Transforming Mathematics Classrooms to Become Equitable and Empowering Spaces for Black and Brown Students: What Kinds of Opportunities Should We Create?

In this presentation, we will use the context of the Wakanda (from the Marvel Movie Black Panther) and our pedagogical imaginations to consider how we might transform mathematics classrooms to become equitable and empowering spaces for Black and Brown students. In particular, we will consider the ways in which we imagine Wakandan classrooms might be organized so that students become forward-thinking and willing to take mathematical risks, as they engage in rigorous and ambitious mathematical tasks. For example, how did Shuri learn to develop her technological skills we see displayed in the movie? How did T'Challa learn to use the Black Panther suit and vibranium technology so skillfully? These questions allow us to re-imagine what types of mathematical learning experiences and what kind of learning environments we should create for preK-12 students, especially for Black, Latinx, and Indigenous students who are most disadvantaged by our current system and practices as we seek to rehumanize mathematics classrooms and support students with developing (or maintaining) a positive mathematics identity.

about Jackie Greenwood

Jackie Greenwood is a facilitator of math education at Summit High School in the Bend-La Pine School District. She attended the State University of New York (SUNY) at Fredonia where she received her undergraduate degree in Secondary Math Education and continued her education at the University of Oregon with a master's degree in Educational Leadership. During her 15- year tenure as a teacher, she has worked to build a classroom environment that honors both the conceptual understanding and the procedural fluency of her students so that they may develop into well rounded mathematicians. Jackie accomplishes this by focusing not only the content standards, but the standards for mathematical practice. Her passion for the importance of the math practices was ignited through her work with *Routines for Reasoning* by Grace Kelemanik, Amy Lucenta, and Susan Janssen Creighton. Their work is a foundation to understand how routines support secondary math students learning to be mathematicians. The routines are also an important source of inspiration for Jackie and colleagues to unpack the math modeling practice standard and played a huge role as they began developing routines for reasoning to help support students as they move through the modeling cycle.

CONCURRENT 2

Teacher Leader Collaborations to Design, Enact and Refine Mathematical Modeling Instructional Routines

Leading session with Heather Bussmann and Rebekah Elliott.

Classroom mathematical modeling demands that teachers and students renegotiate the mathematical work they do together and how that work gets done. Many of the mathematical modeling materials for teachers provide insights on modeling as a cycle of activity integrating real-world and mathematical situations, promoting problem formation, mathematizing problems, and coordinating a mathematical model and justification to make meaning within the real world. Although seemingly well defined, this cycle doesn't help us unpack the multi-faceted decision making that happens within each phase and across phases of the cycle. Modeling resources such as tasks and professional



development supports provide an image of mathematical activity; yet, they don't provide insights on effective instruction of mathematical modeling and how to improve it.

The presenters in this session have worked over the past two years, to understand modeling instruction and ways to support teachers and students to successfully navigate modeling tasks. To this end, they have designed, enacted, and refined, what colleagues Grace Kelemanik and Amy Lucenta call, mathematics routines for reasoning. In this session, we share modeling routines that align with specific mathematical goals and are repeatable structures for supporting students to engage in elements of the modeling cycle. The routines highlight the work of making and defining assumptions and variables in the problem formation phase of modeling and critiquing and iterating models to make meaning within the context of the task. We fondly call these two routines, Donkey U Me and Is It Good Enough. These routines focus on elements of the modeling cycle, without taking on the whole cycle, with the intention to support each and every student in the highly challenging mathematical work of defining and critiquing, essential to mathematical modeling. We have found that although these routines were developed for secondary mathematics modeling, they can be adapted to a variety of mathematical tasks and across K-12 content to leverage defining and critiquing as mathematical practices.

In this session, we will examine the two mathematical modeling routines, Donkey U Me and Is It Good Enough, with mathematics tasks accessible to a broad preK-12 audience. Session presenters will rehearse using the routines with participants and discuss the goals for each element of the routines. From this experience, we will talk about teacher learning and collaboratively consider how leaders may support teachers using the routines to navigate the complexity of mathematical modeling. We conclude with time for participants to consider and share how routines can be taken up to support key features of mathematical modeling inside of curricular resources, gain insights from presenters who have used these routines across a variety of tasks, and talk with colleagues as leaders of equity and mathematics to advance mathematical modeling.

about Linda Griffin

Linda Griffin is an Associate Professor at Lewis & Clark graduate school of education and counseling. She has been a mathematics educator serving K-12 students, teachers, and the broader education community for over 35 years. Linda brings a strong equity focus to her work in preservice elementary mathematics and clinical practices. Her recent research includes work in culturally responsive supervision and dialogic teaching in mathematics. She has experience designing and implementing extracurricular activities in science, technology, engineering, and mathematics for Native American and Mexican-American girls. She has also worked with parents to increase their involvement in mathematics. Linda has provided professional development for mathematics teachers with a focus on the needs of English language learners.

CONCURRENT 1 AND 7

New Possibilities for Parents as Partners in the Mathematics Education of Bilingual Learners

Leading session with Marta Civil.

Parents of Bilingual learners are a valuable and often untapped resource for enhancing mathematics outcomes in schools. This session will draw on several mathematics education projects related to working with parents / families mostly of Mexican origin and Spanish speaking. The principles and activities can be adapted to different groups of parents. This work is based on the idea of parents as intellectual resources (Civil & Andrade, 2003), which sees parents as experts with knowledge and experiences they can contribute to towards students' mathematics education. We will share an approach to parental engagement in mathematics that starts with "parents as parents" but also includes "parents as learners", "parents as facilitators", and "parents as leaders."



We will share activities aimed at:

- a) engaging parents in mathematics explorations (family mathematics workshops as well as Math For Parents courses)
- b) engaging teachers to learn from parents' / families' uses of and experiences with mathematics
- c) establishing a dialogue about mathematics between parents and teachers
- d) facilitating a parents' visit to a mathematics classroom
- e) supporting teachers to view parents as intellectual resources and partners for student success.

We will use a combination of hands-on-activities and videoclips to illustrate these different components. We will draw on lessons learned from listening to parents to discuss implications for teaching of mathematics, particularly in diverse settings with bilingual / multilingual students. Our goal is to highlight the importance of paying attention to linguistic and cultural resources as well as to parents' perceptions about the teaching and learning of mathematics. We will provide suggestions for leaders (e.g., teacher leaders, mathematics coaches, administrators) to engage and support preK-10 teachers in their work with parents.

Civil, M., & Andrade, R. (2003). Collaborative practice with parents: The role of the researcher as mediator. In A. Peter-Koop, V. Santos-Wagner, C. Breen, & A. Begg (Eds.), *Collaboration in teacher education: Examples from the context of mathematics education* (pp. 153-168). Boston, MA: Kluwer.

about Ruth Heaton

WELCOME, INTRODUCTIONS, AND CLOSINGS

Ruth Heaton is the Chief Executive Officer (CEO) of Teachers Development Group (TDG) since August 2017. TDG is a nonprofit provider of mathematics professional development for K-12 teachers and leaders nationwide, whose mission is to improve all students' mathematical understanding and achievement. Ruth and her TDG colleagues collaborate with districts, educational service units, universities, and various public and private funding agencies to design, provide, and math study professional development nationwide. TDG is currently serving teachers and leaders in 13 states and 40 school districts. While the professional development design and implementation takes a variety of forms depending on the particulars of teacher, leader, school, and district contexts, all services provided by TDG are built on the belief that every student is a capable mathematical thinker and has the right to have access to rigorous learning opportunities of the highest quality. As CEO, Ruth continues to work at the intersection of research and practice, the intellectual space that has been the site of Ruth's teaching and scholarship over her entire academic career. Ruth holds an affiliated faculty appointment with the Department of Mathematics and Statistics at Portland State University. She was the Gilmartin Professor of Mathematics Education at the University of Nebraska-Lincoln, where she held a faculty appointment for more than 20 years in the Department of Teaching, Learning, and Teacher Education. Ruth is a recipient of the Nadine Bezuk Excellence in Service and Leadership Award from the Association of Mathematics Teacher Educators.

about Kristine Ho

Kristine Ho has been Director of Math Programs at UCLA, Center X for almost three years. The UCLA Mathematics Project (UCLAMP) is part of a statewide program that strives to make a positive impact on TK-12 educators, students, communities and school districts in the Los Angeles basin. We partner with these entities to provide rich and transformative Mathematical experiences in urban schools. Based on thirty-six years of research and experience, UCLAMP has developed programs that help prepare equity-focused, reflective, and responsive leaders in Mathematics. Prior to her position at UCLA, Kristine served as an Adjunct Professor at the USC Rossier School of Education where she taught Math methods for elementary and secondary candidates. She has also spent the last 10 years engaging in and growing the work around Cognitively Guided Instruction by providing training and support in schools around Los Angeles. Kristine also served in the Teacher Education Program at the University of California, Los Angeles as a Supervisor for a Secondary Mathematics Candidates. Prior to her work at UCLA, she was a secondary mathematics teacher in Centinela Valley Unified School district. Kristine received her Ph.D. in Urban Schooling as DiME (Diversity in Math Education) Fellow from University of California, Los Angeles, M.Ed from University of California, Los Angeles, B.A. in Mathematics and B.A. in Linguistics from the University of Washington.

CONCURRENT 3 AND 7

Redefining Math Instruction: Raising Issues of Identity, Coherence, and Assets Within an Urban School District

Leading session with Virginia Bastable.

Helping teachers come to see their students as capable mathematical thinkers requires both mathematical and pedagogical knowledge. Many teachers have had limited opportunities to experience mathematics as a set of coherent ideas which develop over time. This is limiting when they need to seek the potentially rich mathematics in partially correct or even incorrect answers. Making connections across the grade levels is necessary if teachers are to honor the contributions of all students. Current schooling structures often isolate teacher collaboration to peers at their own grade level, therefore, opportunities to see the relationship between the mathematical ideas they are responsible for teaching and the content in previous or latter grades is constrained.

Pedagogical approaches commonly used in one level (elementary, middle, and secondary) are often different from those at another, and the limited vertical articulation can create barriers for teachers to share these practices. For teachers to be able to build on previous student success and to recognize the contributions of all students, they need a wide range of understanding of both mathematics and of varied instructional approaches.

A partnership between the Los Angeles Unified School District (LAUSD) Local District West and the University of California at Los Angeles Math Project (UCLAMP) was formed to create professional development opportunities to support teachers and administrators of grades 4 through Algebra I to come to see each other as colleagues working together to support the development of every student's math knowledge, voice and identity.

In the partnership, educators:

- expand their own mathematical knowledge
- deepen their abilities to solicit and use student thinking
- recognize and support the brilliance of all students
- create classroom communities which support diverse and varied participation
- examine, analyze, and, eventually, adopt a set of principled ideas about student learning

While these objectives describe the partnership between LAUSD and the UCLA Math Project, they will also serve as the basis for this session. In a microcosm, we will be actively participating in the same work as the partnership teachers and administrators. The session will include work with partnership tools such as the student work analysis



form, will provide time to discuss the Principled Ideas which underlie the work, and will offer details of the different professional development structures of the partnership for both teachers and administrators.

At the core of this partnership are the Principled Ideas of UCLAMP. During this session we will explore how these are relevant and applicable to issues of equity and access of transformative mathematics for ALL students. Throughout the session participants will have the opportunity to consider the implications of the UCLAMP Principled Ideas and the project's PD structures for their own instructional contexts.

about Kara Jackson

Kara Jackson is an associate professor of mathematics education at the University of Washington, Seattle, USA. Her research focuses on how to support a broad range of learners to participate substantially in rigorous and personally meaningful mathematical activity, and how to support teachers to develop such forms of practice at scale. In *Systems for instructional improvement: Creating coherence from the classroom to the district office* (Cobb, Jackson, Henrick, Smith, & The MIST Team, 2018), she and colleagues share what they learned from partnering with multiple districts for many years regarding how to design for instructional improvement across a district. Kara currently leads an NSF-funded project (<https://www.pmr2.org/>) aimed at developing tools, routines, and data representations that practitioners can use to engage in frequent, disciplined inquiry regarding the implementation of instructional improvement strategies in middle-grades mathematics. She taught secondary mathematics in Vanuatu, South Pacific as a U.S. Peace Corps volunteer and was a mathematics specialist, supporting both youth and their families, for the Say Yes to Education Foundation in Philadelphia.

CONCURRENT 2 AND 3

Using Data from "Practical Measures" to Reflect on and Improve Classroom Practice and Professional Learning

Leading session with Hilda Borko, Anita Lenges, and Michael Jarry-Shore.

Instructional leaders who plan and facilitate professional learning (e.g., coaching, workshops, collaborative experiences) often have limited ways to get systematic, targeted, ongoing feedback about teachers' current instructional practices or teachers' perceptions of professional learning. In this session, we will introduce a system of "practical measures," or tools, that are intended to provide leaders (and teachers) with frequent feedback that enables them to assess and adjust their practice. One set of tools (classroom practical measures) are intended for leaders to use in their work with teachers to reflect on and set goals for instructional improvement. The second set of tools (professional learning practical measures) are intended to support leaders to reflect on and set improvement goals for the design and facilitation of professional learning. The measures have been designed in partnership with multiple districts who share ambitious goals for teacher practice and student learning in middle-grades mathematics. Both sets of measures are easy to administer, and the resulting data is easily analyzed and acted upon. Importantly, these tools are intended to support improvement, not to be evaluative.

In the session, we will first provide background on "practical measures," and what motivated partnerships between researchers and district math leaders to design a system of measures. Second, we will introduce classroom practical measures, with an explicit emphasis on how the measures can surface issues of equity. The launch, small-group discussion, and whole-class discussion measures each take the form of a student survey that elicit students' perspectives of instruction and can be administered in 1-3 minutes. Associated data representations are made available via a dashboard interface that displays the resulting data in a variety of ways intended to support practitioners to track and set goals for improvement. Participants will work collaboratively to make sense of the



classroom measures and to examine some sample data and representations. Third, we will introduce professional learning practical measures, which are currently in development. At present, the measures focus on whether a culture has been established in which all teachers willingly share and press on each other's ideas; the nature of teachers' pedagogical reasoning; teachers' perceptions of the relevance of the activity; and teachers' experiences of making practice public. We will invite participants to think with us about how we might refine the professional learning measures to capture what leaders view as important. The session will close with time for participants to consider how they might want to embed the measures in their ongoing efforts to improve teaching and learning. While examples come from work with teachers at grades 6-8, applicability to professional learning across the preK-12 spectrum will be discussed.

about Vicki Jacobs

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 Cognitively Guided Instruction (CGI)—a research and professional development project which introduced her to the wonder and power of young children's ways of reasoning in mathematics. She enjoys collaborating with researchers and teachers to explore instruction that builds on children's reasoning and the other resources children bring to the classroom. She and Susan Empson are currently collaborating on a multi-institution project funded by the National Science Foundation to investigate teaching and learning fractions in the upper elementary grades. She has extensive experience facilitating professional development for teachers and particularly values long-term collaborations with teachers and school districts. She earned her PhD at the University of Wisconsin, spent much of her academic career at San Diego State University and the Center for Research in Mathematics and Science Education (CRMSE), and is now working on understanding and supporting teacher learning in North Carolina.

CONCURRENT 2 AND 5

Building Understanding of Fractions by Using Equations That Capture Children's Ideas

Understanding fractions flexibly is essential for making sense of operations with fractions, yet developing this understanding is challenging. This session will spotlight two related tasks that we have found to be powerful for supporting this goal. First, teachers can provide multiple opportunities for children to solve story problems in ways that make sense to them and then ask children to explain their strategies. These problem-solving experiences allow children to explore fractions in meaningful real-world contexts, and explaining their thinking not only deepens their understandings but also reveals their "budding" understandings. Second, teachers can pose one or more follow-up equations linked to children's "budding" understandings to help children consolidate those understandings—a less typical yet powerful use of equations.

How are these follow-up equations different than the equations we traditionally use in fraction instruction? They begin with children's ideas! For example, when solving a story problem about sharing pizzas, a child discovered that $\frac{5}{8}$ of a pizza was $\frac{1}{8}$ more than $\frac{4}{8}$ of a pizza and thus bigger than $\frac{1}{2}$ of a pizza. This relationship was not immediately obvious to the child who initially thought that $\frac{5}{8}$ of a pizza was less than $\frac{1}{2}$ of a pizza. After listening to this reasoning, a teacher might pose a follow-up equation ($\frac{5}{8} = \frac{4}{8} + \underline{\quad}$) to help the child consolidate their "budding" understanding of this fraction relationship, which arose from the child's reasoning. In contrast, in much fraction instruction, the teacher targets a fraction such as $\frac{4}{8}$, and then poses equations asking children to compute with one of the four operations ($4 \times \frac{1}{8} = \underline{\quad}$) or to express fractions in simplest form ($\frac{4}{8} = \underline{\quad}$). Children do need to be able to solve these traditional tasks, but we have found that linking equations to children's ideas during problem solving not only provides children more access to the mathematics but also honors their ways of reasoning and deepens their understandings.



In this session, we will watch video examples of teachers posing strategic follow-up equations to grades 3-5 children engaged in solving story problems. We will practice watching and listening to children to identify their “budding” understandings and then craft follow-up equations linked to those understandings. Finally, we will consider how to support teachers across a wide range of grade levels to gain the expertise needed to use follow-up equations to capture student’s budding understandings during instruction.

about **Amanda (Mandy) Jansen**

Amanda Jansen is a mathematics teacher educator. Mandy taught grades 7-9 in Mesa, Arizona. She earned her Ph.D. in Educational Psychology from Michigan State University in East Lansing, Michigan. She is a professor in the School of Education at the University of Delaware in Newark, Delaware. At UD, she teaches undergraduates who are studying to be elementary teachers and middle school mathematics teachers. She also conducts professional development for secondary mathematics teachers. Her research focuses on fostering engaging mathematics instruction. NCTM published her first book, *Motivation Matters and Interest Counts*, which was co-authored by Jim Middleton at Arizona State University. Her latest book, *Rough Draft Math*, will be published by Stenhouse in March, 2020. Mandy would like to connect with you on Twitter! @MandyMathEd

CONCURRENT 1 AND 6

Planning to Incorporate Rough Draft Thinking and Revising into Mathematics Lessons

Rough draft thinking in mathematics classrooms takes place when students share ideas while they are still “under construction.” In a classroom that explicitly invites rough drafts, students’ in-progress ideas are positioned as valuable for supporting everyone’s learning. Students also have opportunities to revise their thinking when teachers incorporate rough drafts during mathematics lessons. During this session, we will experience and explore revising experiences that can be enacted during a part of a mathematics lesson. These revising experiences are generally relatively short (~10 minutes) and can be designed using most curriculum materials. The revision experiences give students chances to not only to correct errors, but also to increase precision, to elaborate, to further illustrate, or to make other improvements that allow for refining ideas.

Here at this year’s TDG leadership seminar, I will debut a Rough Draft Thinking Planning Protocol for teachers to use to plan revision experiences for mathematics lessons. We will take time during the session to use the protocol. Participants can expect to leave with a planned revision experience to enact. Participants are encouraged to bring mathematics tasks for upcoming lessons with them to this session so that they can draw upon them when using the planning protocol. Additionally, the planning protocol can be an artifact to use after the leadership seminar; the planning protocol can be a way to engage with colleagues about incorporating revising during mathematics class. I will also elicit feedback from participants about the planning protocol, as I share at the leadership seminar as a work in progress.

Most of the mathematics content in the revision experiences during this session will be targeted at grades 6-10, but the Rough Draft Thinking Planning Protocol can be used at any grade level. Additionally, modifications to the revision experiences and the planning protocol are encouraged, so this session can benefit teachers and teacher leaders at all grade levels. Rough draft thinking affords connections to equity in part because recognizing the potential in students’ draft ideas is a part of developing an asset-based orientation toward students’ thinking. In a classroom where rough drafts are welcome, students’ ideas are valued at any stage of development.

about Michael Jarry-Shore

Michael Jarry-Shore is a doctoral student in the Stanford Graduate School of Education, where he is advised by Dr. Hilda Borko. In his research, Michael is interested in what teachers need to know and be able to do in order to implement ambitious visions of mathematics instruction described by both researchers and education organizations like the National Council of Teachers of Mathematics. He is particularly interested in the complex cognitive work of “noticing” and approaches for supporting teachers in learning to notice. For his dissertation, Michael is examining teachers’ noticing of and responses to student struggle in the middle-school mathematics classroom, whereas for his qualifying paper, he studied four early-career teachers’ in-the-moment noticing of students’ mathematical thinking. Michael taught mathematics to students in the 7th-, 8th-, and 9th-grades for a period of seven years, an experience that shaped his particular research interests. Michael presently works as a research assistant on two projects, one examining a professional development initiative focused on preparing teacher leaders to lead their own site-based professional development workshops, and a second examining the use of “practical measures” student surveys that offer teachers immediate, actionable feedback on aspects of their teaching practice.

CONCURRENT 2 AND 3

Using Data from “Practical Measures” to Reflect on and Improve Classroom Practice and Professional Learning

Leading session with Kara Jackson, Hilda Borko and Anita Lenges.

Instructional leaders who plan and facilitate professional learning (e.g., coaching, workshops, collaborative experiences) often have limited ways to get systematic, targeted, ongoing feedback about teachers’ current instructional practices or teachers’ perceptions of professional learning. In this session, we will introduce a system of “practical measures,” or tools, that are intended to provide leaders (and teachers) with frequent feedback that enables them to assess and adjust their practice. One set of tools (classroom practical measures) are intended for leaders to use in their work with teachers to reflect on and set goals for instructional improvement. The second set of tools (professional learning practical measures) are intended to support leaders to reflect on and set improvement goals for the design and facilitation of professional learning. The measures have been designed in partnership with multiple districts who share ambitious goals for teacher practice and student learning in middle-grades mathematics. Both sets of measures are easy to administer, and the resulting data is easily analyzed and acted upon. Importantly, these tools are intended to support improvement, not to be evaluative.

In the session, we will first provide background on “practical measures,” and what motivated partnerships between researchers and district math leaders to design a system of measures. Second, we will introduce classroom practical measures, with an explicit emphasis on how the measures can surface issues of equity. The launch, small-group discussion, and whole-class discussion measures each take the form of a student survey that elicit students’ perspectives of instruction and can be administered in 1-3 minutes. Associated data representations are made available via a dashboard interface that displays the resulting data in a variety of ways intended to support practitioners to track and set goals for improvement. Participants will work collaboratively to make sense of the classroom measures and to examine some sample data and representations. Third, we will introduce professional learning practical measures, which are currently in development. At present, the measures focus on whether a culture has been established in which all teachers willingly share and press on each other’s ideas; the nature of teachers’ pedagogical reasoning; teachers’ perceptions of the relevance of the activity; and teachers’ experiences of making practice public. We will invite participants to think with us about how we might refine the professional learning measures to capture what leaders view as important. The session will close with time for participants to consider how they might want to embed the measures in their ongoing efforts to improve teaching and learning. While examples come from work with teachers at grades 6-8, applicability to professional learning across the preK-12 spectrum will be discussed.



about **Ondrea Johnston**

Ondrea Johnston is an Assistant Director of K-12 Mathematics in Boston Public Schools (BPS) where she serves to provide content-based professional development for teachers and to provide tools to teachers, teacher leaders, and school leaders for evaluating the effectiveness of instructional practices in the math classroom. She supports both individual teachers and schools in the implementation of standards-aligned curriculum programs and works with the BPS Math Office to offer professional development for a core group of educators (Math Facilitators) representing the 125 schools in BPS, with hopes of influencing instructional practices in all BPS mathematics classrooms. Ondrea has been in the field of education for the past 17 years, serving in several different roles including middle and high school math teacher, as well as, school-based administrator. After double majoring in secondary education and mathematics at Vanderbilt University, she began teaching 8th grade math in rural Georgia. She moved to Boston two years later where she taught middle and high school before taking on school-based administrative roles. Ondrea earned her master's through the Harvard Extension School program in Mathematics for Teaching and her C.A.G.S. in Educational Administration from UMass Boston.

CONCURRENT 1 AND 4

Building School Capacity for More Equitable Teaching Practices through Math Teacher Leadership

Leading session with Linda Ruiz Davenport.

In this session, we share our current successes and challenges collaborating with approximately 100 math teacher leaders representing elementary, middle, and high school grade bands as we explore practices that promote equitable and high-quality math instruction. This work builds on prior math teacher leadership work using NCTM's Principles to Action, *The Impact of Identity in K-8 Mathematics*, *Taking Action: Implementing Effective Mathematics Teaching Practices*, *A Fresh Look at Formative Assessment in Mathematics Teaching*, and the NCSM/TODOS position paper *Mathematics Education Through the Lens of Social Justice*—all of which have helped raise awareness and shift math teaching practice.

Despite this rich and engaging work, there are challenges, particularly given the district's assessment culture focusing on frequent periods of testing and reteaching, levels of accountability based on test results, and test-prep strategies that many teachers embrace as a result of these pressures. This is further complicated by our limited access to school administrators who are held even more accountable to test results.

In this year's work, we are being more explicit with our math teacher leaders about the instructional practices that lead to more equitable and high-quality math instruction we expect them to use in their own classrooms using *5 Practices in Practice* (2019; Peg Smith et al.). In addition, we are being more explicit about expectations for how math teacher leaders collaborate with colleagues to support their use of these instructional practices in their own classrooms. Finally, we are being more explicit about expectations for their ongoing collaborations with school administrators to develop plans that support collaboration with colleagues in ways that build a school commitment to these instructional practices. We will share how this work is unfolding in schools, including any evidence we have about how the teaching practices of math teacher leaders seem to be shifting, how their work with colleagues is unfolding, and the extent to which school administrators are becoming partners in this work.

As we share this work, we also make time to hear from participants about the math teacher leadership work they are supporting in their schools and districts, including how their work is structured, successes and challenges, and the structures they leverage as they work to strengthen math teaching and learning. By the end of the session,



we hope to identify a range of pathways forward as we all work to build school capacity for equitable teaching practices through math teacher leadership.

about Grace Kelemanik

Grace Kelemanik, co-founder of Fostering Math Practices, has more than 30 years of mathematics education experience. A frequent presenter at national conferences, her work focuses on fostering mathematical thinking practices in all students. 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. 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

PRE-SESSION

Leverage the Repeatable Nature of Reasoning Routines to Develop Equitable Math Teaching Practices

Leading session with Amy Lucenta.

We must engage students in critical mathematical thinking and implement equitable teaching practices to provide access and support to each and every learner so that practices are never an 'add on.' Developing such equitable teaching practices requires changing current practices—often ones that are deeply rooted after years of use. In this full day session, K-12 participants will learn and practice activities incorporating video and vignettes to develop specific teaching practices to support facilitating meaningful math discourse, posing purposeful questions, and supporting productive struggle. Participants will learn (1) how to capitalize on the repeatable nature of routines for reasoning to develop equitable teaching practices; (2) how five high leverage teaching strategies built into the routines provide access to each and every learner; and (3) how to implement and share with colleagues the teaching practices, session ideas, and resources of the workshop.

about Christina Koehne

Christina Koehne is a Ph.D. student studying Mathematics Education in the Mathematics Department at Texas State University. At Texas State, Christina has taught a number of mathematics and mathematics education courses, and is working on various research projects with Dr. Kate Melhuish, Dr. Jessica Bishop, and Dr. Hiroko Warshauer. Her dissertation research focuses on future elementary teachers' conceptions of mathematical practices, and what supports are evident and reflected on when recalling their interactions with students. Christina has her Master's degree in Mathematics from Texas State and Bachelor's in Mathematics with Teaching Certification from Texas A&M University-Kingsville. In the summers, she works as a camp instructor for a two-week summer math camp program for elementary and middle school students, teaching a class of 5th-8th grade students Counting, Logic, Algebra, Number Theory, Geometry, and Probability.

CONCURRENT 5 AND 7

Supporting Teachers and Students in Making Meaning of Mathematical Tasks, Contexts, and/or Language

Leading session with Amanda Sugimoto, Eva Thanheiser, Alejandra Sorto, and Kate Melhuish.

In this session, we will examine ways in which preK-12 teachers can engage students in making meaning of mathematical tasks, contexts, and/or language. The session will be framed by the TDG Math Habits research app with a particular focus on the teaching routine of making meaning tasks, contexts, and/or language, as well as the



related teaching habits and student habits that can support this routine. Participants will engage in making sense of the larger teacher routine both with respect to how to begin coaching teachers to implement this routine and how to further support teachers who are already implementing this routine. The routine can be used to support more equitable access and provide an opportunity for students to engage more meaningfully with important mathematical concepts and properties. Ultimately, we hope participants will identify ways that they might continue this work in their own teaching and/or teacher leader contexts. The session will engage participants in the following activities:

1. Analyze tasks for areas of potential confusion for students related to the task, context, and/or language that could emerge during the task launch and lesson;
2. Observe video clips where teachers have implemented the tasks and made specific teaching moves to support students in making meaning of the task, context, and/or language of task;
3. Revisit videos to see how teachers could continue to press students to make sense of specific math concepts and properties as a way of extending student discourse and thinking;
4. Identify ways in which participants might use the collected teacher and student moves from the session to support teacher development in their own educational contexts

about Anita Lenges

Anita Lenges is a Clinical Associate Professor of mathematics teacher education at the University of Washington. Currently, her primary work is in developing teachers' instructional practices and school professional learning environments that encourage experimentation, innovation and excellence. She was a faculty member at The Evergreen State College 2005-2014, where she taught curriculum, instruction, assessment and critical social justice in the Master in Teaching Program, Master of Education program and Colonialism and Decolonization in the undergraduate curriculum. Lenges was awarded a University of Washington Distinguished Teaching Award in 2003 and a University of Washington Continuum College 2017 Teaching Excellence Award. Lenges taught middle and high school for 10 years between 1987 and 2000, first in Kenya with the U.S. Peace Corps and then in the Northshore School District. She has conducted research studies and published on teacher learning, teacher preparation for diverse, urban schools, and the mathematical knowledge for teaching. She has facilitated and designed professional development for 25 years, working with k-12 teachers of mathematics.

CONCURRENT 2 AND 3

Using Data from "Practical Measures" to Reflect on and Improve Classroom Practice and Professional Learning

Leading session with Kara Jackson, Hilda Borko, and Michael Jarry-Shore.

Instructional leaders who plan and facilitate professional learning (e.g., coaching, workshops, collaborative experiences) often have limited ways to get systematic, targeted, ongoing feedback about teachers' current instructional practices or teachers' perceptions of professional learning. In this session, we will introduce a system of "practical measures," or tools, that are intended to provide leaders (and teachers) with frequent feedback that enables them to assess and adjust their practice. One set of tools (classroom practical measures) are intended for leaders to use in their work with teachers to reflect on and set goals for instructional improvement. The second set of tools (professional learning practical measures) are intended to support leaders to reflect on and set improvement goals for the design and facilitation of professional learning. The measures have been designed in partnership with multiple districts who share ambitious goals for teacher practice and student learning in middle-grades mathematics. Both sets of measures are easy to administer, and the resulting data is easily analyzed and acted upon. Importantly, these tools are intended to support improvement, not to be evaluative.



In the session, we will first provide background on “practical measures,” and what motivated partnerships between researchers and district math leaders to design a system of measures. Second, we will introduce classroom practical measures, with an explicit emphasis on how the measures can surface issues of equity. The launch, small-group discussion, and whole-class discussion measures each take the form of a student survey that elicit students’ perspectives of instruction and can be administered in 1-3 minutes. Associated data representations are made available via a dashboard interface that displays the resulting data in a variety of ways intended to support practitioners to track and set goals for improvement. Participants will work collaboratively to make sense of the classroom measures and to examine some sample data and representations. Third, we will introduce professional learning practical measures, which are currently in development. At present, the measures focus on whether a culture has been established in which all teachers willingly share and press on each other’s ideas; the nature of teachers’ pedagogical reasoning; teachers’ perceptions of the relevance of the activity; and teachers’ experiences of making practice public. We will invite participants to think with us about how we might refine the professional learning measures to capture what leaders view as important. The session will close with time for participants to consider how they might want to embed the measures in their ongoing efforts to improve teaching and learning. While examples come from work with teachers at grades 6-8, applicability to professional learning across the preK-12 spectrum will be discussed.

about Amy Lucenta

Amy Lucenta, co-founder of Fostering Math Practices, has extensive K-12 mathematics experience with a focus on developing the standards for mathematical practice in each and every student. She supports teachers, districts, and educational collaborative organizations as they refine 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 recently worked as a secondary mathematics Clinical Teacher Educator for the Boston Teacher Residency Program. Amy is the co-author of *Routines for Reasoning: Fostering Mathematical Practices in All Students*, published by Heinemann. Follow Amy on Twitter @AmyLucenta

PRE-SESSION

Leverage the Repeatable Nature of Reasoning Routines to Develop Equitable Math Teaching Practices

Leading session with Grace Kelemanik.

We must engage students in critical mathematical thinking and implement equitable teaching practices to provide access and support to each and every learner so that practices are never an ‘add on.’ Developing such equitable teaching practices requires changing current practices—often ones that are deeply rooted after years of use. In this full day session, K-12 participants will learn and practice activities incorporating video and vignettes to develop specific teaching practices to support facilitating meaningful math discourse, posing purposeful questions, and supporting productive struggle. Participants will learn (1) how to capitalize on the repeatable nature of routines for reasoning to develop equitable teaching practices; (2) how five high leverage teaching strategies built into the routines provide access to each and every learner; and (3) how to implement and share with colleagues the teaching practices, session ideas, and resources of the workshop.



about Cathy Martin

Cathy Martin currently serves as the Executive Director of Curriculum and Instruction for Denver Public Schools and leads the development of academic supports and resources across content areas and works closely with colleagues to bring equity-based practices to all content-area classrooms. Prior to this, Cathy served as the K-12 Director of Mathematics in Denver for 12 years. In this role, she led standards implementation in mathematics and coordinated the design of professional development for teachers, teacher leaders, and school leaders. Previously, 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 and was a Presidential Awardee in Secondary Mathematics in 2000. Cathy is currently an Associate Editor for the new NCTM Journal launching in 2020, *Mathematics Teacher: Learning and Teaching PK-12*. She is active in the Council of Great City Schools where she serves on the mathematics advisory board. Cathy also serves on the TDG Board of Directors.

CONCURRENT 5 AND 6

Building Capacity and Leadership to Support a District-wide Focus on K-12 Mathematics Teaching and Learning

In 2019-20, Denver Public Schools elevated a focus on K-12 mathematics as a district-wide instructional improvement priority. Building on the work already in place around a strategic plan for secondary mathematics, we developed a strategic plan that identified the role of teachers, school leaders, instructional superintendent's and their teams, and central office in support of that work. Rigorous tasks, high expectations, culturally and linguistically responsive instruction and feedback to advance student learning all grounded in the DPS culturally responsive mindsets for teachers and leaders grounds the work. This session is designed to engage school leaders and teachers in thinking about the systems and structures essential to understanding and enacting ambitious mathematics teaching in all classrooms while addressing issues of equity.

This session will begin with examining some of the findings identified in the study, *The Opportunity Myth* (TNTP, 2018). This study found that assignments, instruction, engagement and high expectations matter a lot, especially to our most vulnerable students. Thus, the objectives for our work with teachers and leaders this year has aimed to:

1. Deepen teachers and leaders' understanding of standards through a learning progression study of a major domain
2. Calibrate on rigorous tasks and high expectations
3. Implement the effective mathematics teaching practices including equity-based, culturally responsive mathematics practices.

Participants in this session will have the opportunity to engage in discussion around the system that we've designed to support teachers and leaders. In addition, participants will engage in some of the activities that have been a part of our work and consider how these activities support teachers in providing rigorous mathematics tasks to all students along with the scaffolds necessary to maintain high expectations. We'll also engage in discussion around the parallel leader learning and consider how that will support leaders to empower their teachers. Participants will also consider and reflect on Denver's learnings and how they might apply that to their work.

about **Kate Melhuish**

Kate Melhuish is an Assistant Professor in the Mathematics Department at Texas State University. Kate's research focuses on the development of measures in mathematics education spanning areas including: teaching observation tools to support high-level reasoning in the classroom, multiple-choice measures of student understanding of concepts and proofs at advanced levels, and self-efficacy. Kate is currently Principal Investigator (PI) of an NSF grant in collaboration with TDG in order to develop and validate the Math Habits Tool (DRL #1814114), as well as PI on a grant focused on promoting student discussion in abstract algebra (IUSE #1836559). The unifying feature of her work is the development of teacher supports and measures that can help promote student engagement in rich mathematics.

CONCURRENT 5 AND 7

Supporting Teachers and Students in Making Meaning of Mathematical Tasks, Contexts, and/or Language

Leading session with Amanda Sugimoto, Eva Thanheiser, Alejandra Sorto, and Christina Koehne.

In this session, we will examine ways in which preK-12 teachers can engage students in making meaning of mathematical tasks, contexts, and/or language. The session will be framed by the TDG Math Habits research app with a particular focus on the teaching routine of making meaning tasks, contexts, and/or language, as well as the related teaching habits and student habits that can support this routine. Participants will engage in making sense of the larger teacher routine both with respect to how to begin coaching teachers to implement this routine and how to further support teachers who are already implementing this routine. The routine can be used to support more equitable access and provide an opportunity for students to engage more meaningfully with important mathematical concepts and properties. Ultimately, we hope participants will identify ways that they might continue this work in their own teaching and/or teacher leader contexts. The session will engage participants in the following activities:

1. Analyze tasks for areas of potential confusion for students related to the task, context, and/or language that could emerge during the task launch and lesson;
2. Observe video clips where teachers have implemented the tasks and made specific teaching moves to support students in making meaning of the task, context, and/or language of task;
3. Revisit videos to see how teachers could continue to press students to make sense of specific math concepts and properties as a way of extending student discourse and thinking;
4. Identify ways in which participants might use the collected teacher and student moves from the session to support teacher development in their own educational contexts.

about **Johannah Nikula**

Johannah Nikula is a Senior Project Director at Education Development Center, where she conducts research, collaborates with teachers, and develops resources focused on mathematics teaching and learning for students with varying English language proficiency levels. She directs projects focused on developing and studying resources for mathematics teachers with students who are emergent multilingual (EMs) in their classes, including development of the Visual Access to Mathematics professional development program and of the Analyzing Diagrams: Supports for English Learners Grade 6 fraction division lessons with built-in supports for students who are EMs. Her previous work has included research and development projects focused on supporting engagement in mathematical practices and lesson study in mathematics professional development. She received an Ed.M from Harvard University with a Technology in Education focus. She is co-author of the books *Mathematical Thinking and Communication: Access for*



English Learners, Fostering Geometric Thinking, and A Mathematics Leaders Guide to Lesson Study in Practice, in addition to numerous articles and blog posts focused on mathematics teaching and learning.

CONCURRENT 5 AND 6

Facilitating Mathematical Practices through Student-teacher Relationships and Diagrams: Focusing on Students who are English Learners

Leading session with Jill Neumayer DePiper.

All students, including students who are emergent multilingual (EMs) (frequently identified by their schools as English learners), need cognitively demanding mathematical learning experiences that emphasize mathematical practices. However, EMs generally have fewer opportunities for classroom participation and mathematical communication than their peers. Integrating diagram use and language production strategies with challenging mathematics tasks promotes EMs' mathematical reasoning and positions EMs as competent doers of mathematics. In this session, participants will learn to use diagrams and language strategies to facilitate EMs' agency in mathematics and participation in mathematical talk. Participants will also examine middle grades student work to explore the ways that diagramming and language strategies can support EMs and will provide the backdrop for consideration of how to support teachers.

Furthermore, to provide the optimum learning experience, teachers must also understand EMs' backgrounds, motivations, and experiences; that is, meeting language needs and facilitating rigorous mathematics experience are essential but not sufficient. Therefore, we will examine the Establish-Maintain-Restore (EMR) framework (Cook et al., 2018) for building student-teacher relationships in mathematics. Teachers' relationships with their students affect student achievement and participation (e.g., Xu & Qi, 2019). We have adapted the EMR framework to make it specific to the work in the mathematics classroom with EMs. This framework focuses on establishing strong relationships with students, maintaining those relationships, and being purposeful about restoring relationships when necessary. We will explore practical strategies for developing student-teacher relationships while facilitating EM engagement in mathematical practices. For example, we'll discuss how teacher use of open-ended mathematical questions with EMs promotes student engagement and affirms the mathematical contributions of the student. Other student-teacher relationship strategies that we will discuss in the context of mathematics include teacher-student interviews and family outreach and communication that focuses on mathematics.

It is critical to tie the work of diagram use and other supports for EMs to specific mathematical content. During this session, we will explore these ideas in the context of middle grades fraction operations and proportional reasoning content—mathematical content that is key to students' mathematical trajectory—but strategies that will be explored during the session can be applied across K-12 and we will support participants to make these connections. Session participants will examine strategies for building stronger student-teacher relationships with EMs in the context of mathematics lessons. Throughout the session we will provide opportunity for planning and reflection on how to implement supports in participants' own preK-12 contexts for mathematics teachers of EMs to use diagrams, integrate language strategies, and build student-teacher relationships.

about Susan Jo Russell

Susan Jo Russell began her career in education as an elementary classroom teacher and coach. 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. 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 a focus on mathematical argument in the elementary grades provides opportunities for students with a history of poor achievement in grade-level computation, students with a history of excelling in grade-level computation, and all their classmates to engage in significant mathematical ideas together. 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 the resource, But Why Does It Work? Mathematical Argument in the Elementary Classroom*, which includes a book, video, and lesson sequences.

CONCURRENT 1 AND 6

Individual and Collective Mathematical Agency in Urban Classrooms

Leading session with Deborah Schifter.

Mathematical agency—believing in and acting on one's own authority in understanding mathematics—cannot be taken for granted in K-12 classrooms. This is especially true for students who have been historically excluded from opportunities to progress toward higher-level mathematics and who belong to groups that have been characterized as having “low attention,” “not motivated,” “slow learners,” “not interested in math,” and otherwise described as, essentially, not being smart enough to engage in significant mathematical thinking (Aguirre, 2019).

For several years, we have been collaborating with groups of teachers to focus on generalizations about the operations (i.e., structures of number systems). In the course of this research, we and our collaborating teachers noticed that when young students engage with the challenge of developing conjectures, investigating those conjectures through their own representations, and constructing arguments based on those representations, they develop greater confidence in their own mathematical agency. At the same time, as students work to articulate their ideas and to understand the thinking of their classmates, that agency becomes collective. Building on classmates' ideas or challenging classmates to explain more clearly, they often move the work further than any individual students could do on their own.

In light of these observations, we became interested in what Aguirre et al. (2013) call “collective mathematical agency,” which they define as follows: “[T]eachers and their students act together to solve problems, working from the shared belief that viable strategies can be developed and solutions can be found. Different students can contribute different elements to this collective agency ... [including] productive reasoning strategies ... explanations of particular mathematical concepts or ... questions that help to clarify problems and concepts [p. 17].” Our educational system is largely organized around individual achievement—unlike much of the adult world, which is organized around collaboration. In our current work in urban classrooms, we are asking questions about what collective mathematical agency is and how it can be supported in elementary classrooms.

In this session, participants will first work together on a mathematics task drawn from the mathematical argument lesson sequences we have developed. Then we will view video clips from grades 1 to 4 classrooms in which students are engaged in similar tasks. We will consider together questions such as: What characterizes collective mathematical agency? When do you know it is happening in the classroom? How might it look similar or different at elementary, middle and high school? How do teachers at all levels support its development? How do individual and collective agency interact? How does collective work support all students to engage in significant mathematics? How can teachers assess student understanding in the context of collective work? How do teacher leaders, coaches, and/or administrators support teachers to teach in ways that allow for both individual and collective agency? While video examples will come from grades 1-4, the ideas of the session and the questions that are considered are relevant across the entire preK-12 grade level spectrum.



Aguirre, J. (2019). *Math strong: Cultivating equity and social justice in mathematics education*. Presented at National Conference of Supervisors of Mathematics Annual Conference, San Diego, CA.

Aguirre, J., Mayfield-Ingram, K., & Martin, D. B. (2013). *The impact of identity in K-8 mathematics*. Reston, VA: National Council of Teachers of Mathematics.

about Deborah Schifter

Deborah Schifter is a consultant in mathematics education. 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* (a revised version now published by NCTM). In recent years, Deborah has been working with colleagues to investigate algebraic thinking at the elementary level. They have produced two books based on this work—*Connecting Arithmetic to Algebra* (Russell, Schifter, & Bastable) and *But Why Does It Work?* (Russell, Schifter, Kasman, Bastable, & Higgins).

CONCURRENT I AND 6

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Aguirre, J., Mayfield-Ingram, K., & Martin, D. B. (2013). *The impact of identity in K-8 mathematics*. Reston, VA: National Council of Teachers of Mathematics.

about Peg Smith

Peg Smith is a Professor Emerita at University of Pittsburgh. Over the past two decades she has been developing research-based materials for use in the professional development of mathematics teachers. She coauthored over 90 books, edited books or monographs, book chapters, and peer-reviewed articles including *Five Practices for Orchestrating Productive Discussions* (co-authored with Mary Kay Stein). Her latest books, *The 5 Practices in Practice: Successfully Orchestrating Mathematics Discussion in Your Classroom* (co-authored Miriam Sherin, Michael Steele and Victoria Bill) take a deep dive into the five practices at each grade band. She was a member of the Board of Directors of AMTE (2001-2003; 2003 – 2005) and of NCTM (2006-2009) and of TDG (2009 – 2017). She was the founding editor of the journal, *Mathematics Teacher Educator*, which is co-published by NCTM and AMTE. In 2006 she was selected to receive the Chancellor's Distinguished Teaching Award given annually to honor outstanding faculty at the University of Pittsburgh. In 2009 she received the award for Excellence in Teaching in Mathematics Teacher Education from AMTE. In April 2019 she received the Lifetime Achievement Award from NCTM.

CONCURRENT 3 AND 5

The 5 Practices in Practice: Addressing the Challenges of Orchestrating Mathematics Discussions and Ensuring Equity (Elementary)

Discussions can be challenging for teachers who are trying to build on and honor students thinking while at the same time ensure that the mathematical ideas that are at the heart of a lesson are clear and public. The five practices (Smith & Stein, 2019) – anticipating, monitoring, selecting, sequencing, and connecting – provide a model for effectively using student responses in whole-class discussions that is intended to make discussions more manageable by moderating the degree of improvisation needed during the lesson. The 5 practices model, however, is not without its challenges. Recent work related to the 5 practices focuses on identifying the challenges associated with each of the practices and illustrating ways that teachers can address those challenges (Smith & Sherin, 2019; Smith, Bill, & Sherin, 2020; Smith, Steele, & Sherin, 2020).

In this session participants will have the opportunity to: 1) engage in activities that highlight three of the challenges (shown below) that teachers face in enacting the 5 practices model; 2) begin to identify what teachers can do to



address the challenges; 3) reflect on how addressing the specific challenges can support equity; and 4) consider how to support teachers' efforts to engage all students in mathematical discussions. Throughout the session participants will engage in analyzing artifacts (e.g., video clips, samples of student work, completed monitoring charts) drawn from elementary classrooms. Although the examples will be elementary, the challenges discussed and ways to address them transcend grade levels.

Practice: Setting Goals and Selecting Task

Challenge: Launching a Task to Ensure Student Access

Description: Teachers need to provide access to the context and the mathematics in the launch but not so much that the mathematical demands are reduced and key ideas are given away.

Practice: Monitoring Student Work

Challenge: Trying to Understand What Students are Thinking

Description: Students do not always articulate their thinking clearly. It can be quite demanding for teachers, in the moment, to figure out what a student means or is trying to say. This requires teachers to listen carefully to what students are saying and to ask questions that help them better explain what they are thinking.

Practice: Connecting Student Solutions

Challenge: Ensuring that Key Mathematical Ideas are Made Public and Remain the Focus

Description: It is possible to have students share a lot of interesting and solutions and never get to the point of the lesson. It is critical that the key mathematical ideas that are being targeted in the lesson are explicitly discussed.

CONCURRENT I

The 5 Practices in Practice: Addressing the Challenges of Orchestrating Mathematics Discussions and Ensuring Equity (Secondary)

Discussions can be challenging for teachers who are trying to build on and honor students thinking while at the same time ensure that the mathematical ideas that at the heart of a lesson are clear and public. The five practices (Smith & Stein, 2019) – anticipating, monitoring, selecting, sequencing, and connecting – provide a model for effectively using student responses in whole-class discussions that is intended to make discussions more manageable by moderating the degree of improvisation needed during the lesson. The 5 practices model, however, it is not without its challenges. Recent work related to the 5 practices focuses on identifying the challenges associated with each of the practices and illustrating ways that teachers can address those challenges (Smith & Sherin, 2019; Smith, Bill, & Sherin, 2020; Smith, Steele, & Sherin, 2020).

In this session participants will have the opportunity to: 1) engage in activities that highlight three of the challenges (shown below) that teachers face in enacting the 5 practices model; 2) begin to identify what teachers can do to address the challenges; 3) reflect on how addressing the specific challenges can support equity; and 4) consider how to support teachers efforts to engage all students in mathematical discussions. Throughout the session participants will engage in analyzing artifacts (e.g., video clips, samples of student work, completed monitoring charts) drawn from algebra classrooms.

Practice: Anticipating Student Responses

Challenge: Moving Beyond the Way YOU Solve a Problem

Description: Teachers often feel limited by their own experience. They know how to solve a task but may not have access to the array of strategies that students are likely to use.



Practices: Selecting and Sequencing Student Solutions

Challenge: Selecting only solutions that are most relevant to learning goals

Description: Teachers need to select a limited number of solutions that will help achieve the mathematical goals of the lesson. Sharing solutions that are not directly relevant can take a discussion off track, and sharing too many solutions (even if they are relevant) can lead to student disengagement.

Practice: Connecting Student Solutions

Challenge: Keeping the entire class engaged and accountable during individual presentations

Description: Often, the sharing of solutions turns into a show and tell or a dialogue between the teacher and the presenter. The rest of the class needs to be held accountable for understanding and making sense of the solutions that are presented.

about **Alejandra Sorto**

Alejandra Sorto, Professor in the Mathematics Department at Texas State University, editorial board member of the journal *Teaching for Equity and Excellence in Mathematics (TEEM)* and *Research in Statistics Education Journal (SERJ)*. Alejandra teaches mathematics courses to STEM majors, future elementary and middle grades teachers, and graduate students in mathematics education. Her research focuses on the preparation of teachers in the area of Statistics, the impact of professional development, and comparative studies in Latin-America and Africa. In particular, she is interested in developing instruments to measure content knowledge for teaching, teaching quality and analyzing its effect on student achievement. She has worked with governments of Chile, Peru, the Dominican Republic, Honduras, and Guatemala to help improve the preparation of teachers in mathematics and develop educational standards. In 2011, the National Science Foundation (NSF) awarded her a CAREER research grant to investigate the Mathematics instruction of English language learners in the state of Texas.

CONCURRENT 2 AND 4

Exploring the Volume of Mayan and Egyptian Pyramids: Addressing Cultural Relevance and Mathematical Habits to Support the Learning of All Students

During this session, we will engage in a mathematical exploration that integrates geometry models to explore numerical and algebraic relationships while learning about the Mayan culture. Participants will have the opportunity to experience the implementation of a mathematical exploration that addresses cultural relevant aspects such as the mathematics and history of the Mayan culture while engaging in mathematical teaching and student habits. The exploration is rich enough that teacher leaders can adjust it to place more emphasis on the cultural and historical aspect or in the mathematical relationships or the connections to higher-level mathematics. The main exploration question will be Does the volume formula still holds if we consider a pyramid with a base that is not a square? To answer this question, we will

- develop strategies to determine the volume of selected prisms and pyramids;
- use three-dimensional representations to visualize and solve problems involving area and volume;
- use geometric models to represent and explain numerical and algebraic relationships; and
- recognize and apply geometric ideas and relationships in subjects outside the mathematics classroom, such as history and culture.

By building models, students and teachers can study three-dimensional geometric shapes and analyze their properties. By exploring different models that relate to history and culture, students will deepen their understanding



of general relationships and applications. The actual calculations of the areas of the bases and volume can enhance students' strategies for counting and looking for patterns. This rich activity has connections to patterns and proportional and algebraic reasoning; it can extend to calculus concepts, such as the convergence of series and limits; and explores cultural relationships. Teachers leaders, mathematics coaches, and administrators can support teachers implement these types of activities by designing lessons that integrate history, culture, and art. Although it is challenging to find resources of this type, this particular lesson was first published in *Mathematics Teaching in the Middle School* NCTM Journal (Sorto, 2009), and now it is part of a recent published online book entitled *Integrating Math Across the K-6 Curriculum* (NCTM, 2018). This online resource contains 70 downloadable articles and more than 100 lessons that incorporates mathematics with natural sciences, social studies, and art. This session will serve as a model for teacher leaders at all preK-12 levels to develop and support their teachers on how to implement lessons of this nature.

CONCURRENT 5 AND 7

Supporting Teachers and Students in Making Meaning of Mathematical Tasks, Contexts, and/or Language

Leading session with Amanda Sugimoto, Eva Thanheiser, Kate Melhuish, and Christina Koehne.

In this session, we will examine ways in which preK-12 teachers can engage students in making meaning of mathematical tasks, contexts, and/or language. The session will be framed by the TDG Math Habits research app with a particular focus on the teaching routine of making meaning tasks, contexts, and/or language, as well as the related teaching habits and student habits that can support this routine. Participants will engage in making sense of the larger teacher routine both with respect to how to begin coaching teachers to implement this routine and how to further support teachers who are already implementing this routine. The routine can be used to support more equitable access and provide an opportunity for students to engage more meaningfully with important mathematical concepts and properties. Ultimately, we hope participants will identify ways that they might continue this work in their own teaching and/or teacher leader contexts. The session will engage participants in the following activities:

1. Analyze tasks for areas of potential confusion for students related to the task, context, and/or language that could emerge during the task launch and lesson;
2. Observe video clips where teachers have implemented the tasks and made specific teaching moves to support students in making meaning of the task, context, and/or language of task;
3. Revisit videos to see how teachers could continue to press students to make sense of specific math concepts and properties as a way of extending student discourse and thinking;
4. Identify ways in which participants might use the collected teacher and student moves from the session to support teacher development in their own educational contexts.

about Elyssa Stoddard

Elyssa Stoddard is a doctoral student in the STEM Education program, with a focus in mathematics education, at Oregon State University. Prior to attending Oregon State, Elyssa taught high school mathematics ranging from Algebra to AP Calculus in western New York. Currently, she is working with Rebekah Elliott and Megan Brunner on a research-practice partnership project focused on how mathematics teachers, teacher leaders, and districts design, enact, and refine instructional tools to address local problems of practice. She also teaches elementary mathematics methods courses and curriculum courses in the Oregon State University's undergraduate teacher licensure program. Her research interests center on understanding capacities to leverage field experiences in university courses.



CONCURRENT 4 AND 7

Mathematical Modeling Instructional Tools Fostering Student Agency and Equity

Leading session with Jackie Greenwood and Rebekah Elliott.

The Common Core State Standards and new curriculum have increased attention on mathematical modeling for K12 students to critique their world, see the wonder and relevance of mathematics, and explore mathematics useful for career and post-secondary aspirations. State education leaders are supporting aligning mathematics pathways that emphasize the power and opportunity that mathematical modeling may play in mathematics. In Oregon, teachers have worked to incorporate mathematical modeling in their classrooms, responding to NCTM's Catalyzing Change in High School Mathematics. These efforts reveal a need to more clearly explicate the interactions among equity, discourse, and mathematical modeling and to design tools and practices to support students' agency in classrooms.

Through our work with leaders, we have developed instructional tools that support dialogue on equity, mathematical discourse, and modeling to support teachers and leaders to engage in collaborative inquiry on instructional practice and to build a shared vision for equity and mathematical modeling in their schools. These tools elaborate on what a mathematical modeling cycle entails for teachers and students and articulate key ideas about equity, discourse, and modeling in written narratives for teachers, connecting educational research to classroom practice. In this session, we investigate this suite of instructional tools to take up mathematical modeling, discourse, and equity. We do so by considering how leaders may support teachers to engage in deep discussion of these ideas and collaboratively consider how these tools are useful for improving mathematics instruction.

This session attends to two questions in support of teacher and leaders' learning. First, how could we use observation-based rubrics to support mathematics teachers' knowledge and skill with mathematical modeling? Second, how could teachers and students use mathematical modeling as an opportunity to cultivate agency, competence, and identity that fosters greater equitable opportunities for student participation? In this session, we build knowledge and insights on what mathematical modeling looks and sounds like in secondary mathematics classrooms where students have opportunities to develop new mathematical knowledge. We explore these questions through solving and investigating a mathematical modeling task relevant to secondary mathematics and exploring mathematical modeling via classroom artifacts. Although the task we explore is situated in secondary mathematics, K-12 leaders will investigate the two rubrics and practice briefs to further elaborate practices that support K-12 teachers and students to engage in equitable and robust mathematics. Our goals for this session are for leaders and teachers to develop understandings of how mathematical modeling instruction can provide equitable opportunities for student engagement, consider how to introduce mathematical modeling and engage in it with teachers and students, and leave with instructional tools that can guide and support mathematical modeling instruction as equity and mathematics leaders.

about **Amanda Sugimoto**

Amanda Sugimoto is an Assistant Professor in the Department of Curriculum and Instruction in the College of Education at Portland State University. Amanda teaches mathematics methods courses and planning, instruction, and assessment courses for preservice elementary teachers. She particularly focuses on preparing elementary teachers to work with linguistically diverse students in socially just ways. Amanda's research focuses on improving the educational experiences and access of linguistically diverse students in schools, particularly in mathematics.



CONCURRENT 5 AND 7

Supporting Teachers and Students in Making Meaning of Mathematical Tasks, Contexts, and/or Language

Leading session with Eva Thanheiser, Alejandra Sorto, Kate Melhuish, and Christina Koehne.

In this session, we will examine ways in which preK-12 teachers can engage students in making meaning of mathematical tasks, contexts, and/or language. The session will be framed by the TDG Math Habits research app with a particular focus on the teaching routine of making meaning tasks, contexts, and/or language, as well as the related teaching habits and student habits that can support this routine. Participants will engage in making sense of the larger teacher routine both with respect to how to begin coaching teachers to implement this routine and how to further support teachers who are already implementing this routine. The routine can be used to support more equitable access and provide an opportunity for students to engage more meaningfully with important mathematical concepts and properties. Ultimately, we hope participants will identify ways that they might continue this work in their own teaching and/or teacher leader contexts. The session will engage participants in the following activities:

1. Analyze tasks for areas of potential confusion for students related to the task, context, and/or language that could emerge during the task launch and lesson;
2. Observe video clips where teachers have implemented the tasks and made specific teaching moves to support students in making meaning of the task, context, and/or language of task;
3. Revisit videos to see how teachers could continue to press students to make sense of specific math concepts and properties as a way of extending student discourse and thinking;
4. Identify ways in which participants might use the collected teacher and student moves from the session to support teacher development in their own educational contexts.

about **Eva Thanheiser**

Eva Thanheiser is Associate Professor in the Fariborz Maseeh Department of Mathematics and Statistics at Portland State University, board member of the Association of Mathematics Teacher Educators (AMTE), and AMTE board liaison to and editorial board member of the journal, *Mathematics Teacher Educator* (MTE). At Portland State University Eva teaches mathematics content courses for elementary and middle-school teachers as well as courses for PhD students in mathematics education. Eva's research currently focuses on integrating social justice tasks into mathematics classrooms at all levels as well as in collaboration with Teachers Development Group (and funded by two NSF DRK12 grants) examining in-service teacher professional development experiences and working with tools for teachers to implement best practices in mathematics classrooms particularly with the Mathematics Habits and Routines Tool.

CONCURRENT 5 AND 7

Supporting Teachers and Students in Making Meaning of Mathematical Tasks, Contexts, and/or Language

Leading session with Amanda Sugimoto, Alejandra Sorto, Kate Melhuish, and Christina Koehne.

In this session, we will examine ways in which preK-12 teachers can engage students in making meaning of mathematical tasks, contexts, and/or language. The session will be framed by the TDG Math Habits research app with a particular focus on the teaching routine of making meaning tasks, contexts, and/or language, as well as the related teaching habits and student habits that can support this routine. Participants will engage in making sense of the larger teacher routine both with respect to how to begin coaching teachers to implement this routine and how to further support teachers who are already implementing this routine. The routine can be used to support more equitable access and provide an opportunity for students to engage more meaningfully with important mathematical concepts and properties. Ultimately, we hope participants will identify ways that they might continue this



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4. Identify ways in which participants might use the collected teacher and student moves from the session to support teacher development in their own educational contexts.

about **Erin Turner**

Erin Turner is a Professor of Mathematics Education in the Department of Teaching, Learning and Sociocultural Studies at the University of Arizona. Her scholarship focuses on equity and social justice in mathematics education. Specifically, her work examines how mathematics instruction can draw upon children's multiple mathematical funds of knowledge (e.g., their mathematical thinking, as well as their cultural, linguistic and/or community-based knowledge and experiences) in ways that support mathematical understanding and a sense of agency. Because of her particular interest in the mathematics education of Latino/a students, including those who are English Learners (ELs), she situates her work in the context of predominantly Latino/a communities and schools. Erin has authored and co-authored numerous publications in these research areas. She has been a Principal Investigator for numerous NSF-funded research and professional development initiatives, including M2C3: Math Modeling with Community and Cultural Contexts, and TEACH MATH (Teachers Empowered to Advance Change in Mathematics). Erin was a dual language elementary teacher (Spanish/English) in the Phoenix urban core for several years. Additionally, she has led numerous professional development initiatives focused on equity-oriented mathematics teaching for elementary and middle grade teachers and teacher leaders across Arizona.

PLENARY A

Mathematical Modeling: A Critical Lever for Equity in K-12 Mathematics Education

Leading session with Julia Aguirre.

This interactive session will introduce mathematical modeling as an equity lever for K-12 mathematics education. Mathematical modeling leverages student understanding of real-world phenomena including issues of fairness and justice (e.g., Is our water safe? Is this sharing plan fair? How do we know this claim is true?). Modeling is a cyclical process using mathematics to make-sense of and analyze real-world situations through problem posing, decision making, creating, revising, and generalizing. Mathematical modeling is a Common Core high school content standard, a K-12 mathematics practice standard, and measured on state, national, and international assessments (e.g., Smarter Balanced Assessment, PISA). Mathematical modeling and the connections to cultural and community contexts have been underemphasized in mathematics teacher education (pre-service and in-service). Research has shown that mathematical modeling broadens student access to and engagement with rigorous mathematics, while also recognizing and affirming various mathematical strengths of students. Thus, it makes sense to integrate mathematical modeling throughout K-12 education to help provide a strong foundation for mathematical advancement and to take action to improve our world.

In this session, we will share results and lessons learned from a three-year National Science Foundation project that focused on teaching and learning mathematical modeling in grades 3-5 specifically focused on cultural and community contexts. By engaging with community-based modeling tasks, mathematizing-the-world routines, and student work



generated from our project, we will explore how mathematical modeling can help make mathematics rich, rigorous, and relevant for children and youth. We will also share researcher, teacher and instructional coach insights about the supports and challenges of integrating mathematical modeling into instructional practice. Issues of building and district support will be discussed. Professional development resources for culturally responsive and community-based modeling activities will be provided. Our session will conclude with an audience invitation to consider their roles in supporting mathematical modeling as an equity lever for K-12 mathematics.

CONCURRENT 4

Mathematizing the World with Mathematical Modeling K-5: Professional Learning with Elementary Teachers about Mathematical Modeling

Leading session with Julia Aguirre.

Mathematical Modeling is a cyclical process using mathematics to make-sense of and analyze real-world situations through problem posing, decision making, creating, revising, and generalizing. Mathematical modeling leverages student understanding of real-world phenomena including family, community and cultural practices they engage with or can imagine in their daily life. Research has shown that mathematical modeling broadens student access to and engagement with rigorous mathematics, while also affirming various mathematical strengths. Yet, there is limited research on what math modeling looks like in the elementary grades.

In this interactive session, we will share professional development tools and resources developed from a three-year National Science Foundation research project focused on teaching and learning mathematical modeling with cultural and community contexts, in grades 3-5. We will discuss professional learning supports for elementary teachers to teach mathematical modeling that intentionally connects to students' funds of knowledge and lived experiences. We will show examples of project and teacher generated math modeling tasks, samples of student work, and tools for modifying curriculum to be more modeling friendly. Our session will help make the case that mathematical modeling is an equity lever in K-12 mathematics education and is especially powerful for diverse elementary classrooms. Even though our examples will come from grades 3-5, we will discuss the application of the ideas of this session to all grade levels.

about **Angela Chan Turrou**

Angela Chan Turrou, Ph.D. is a senior researcher and teacher educator in the UCLA Graduate School of Education & Information Studies. In her work with preservice and inservice teachers across preschool and elementary settings in the Los Angeles area, Angela leverages purposeful instructional activities driven by children's mathematical thinking to support teacher learning, collaboration, and generative growth. She is continually inspired by teachers who, on a daily basis, create space for children to drive the mathematical work and challenge the broader discourse of who does and does not get to be "good at math." Angela works with the UCLA Mathematics Project to support a large-scale Cognitively Guided Instruction (CGI) professional development partnership with LA Unified Schools. She is also a member of the Development and Research in Early Math Education Teacher Educator (DREME TE) project team and leads the Early Math in Higher Ed project, networking early childhood teacher educators across the state of California. Angela is co-author of *Young Children's Mathematics: Cognitively Guided Instruction in Early Childhood Education* (Heinemann) and co-editor of *Choral Counting and Counting Collections: Transforming the PreK-5 Math Classroom* (Stenhouse).



CONCURRENT 4 AND 6

From Counting to Problem Solving: Challenging Linear Notions of Learning

Leading session with Megan Franke.

Many educators are familiar with our “counting collections” work and its value in supporting children’s thinking and mathematical learning across PreK-5. Counting collections has been particularly powerful in challenging deficit views of children and highlighting the detailed mathematical understandings they bring to the classroom. Over the past many years, we have leveraged this counting work to focus specifically on connections between counting and problem solving. This session will engage participants in detailing children’s mathematical thinking in a way that leverages students’ partial/emergent understandings while challenging conceptions of “mastery” of one mathematical idea before another. We will also address the power of “counting to problem solving” for teacher learning as a deepened understanding of children’s thinking in counting and the operations supports collaborative shifts in teaching practice based on what children know and can do. While video examples will be drawn primarily from PreK-1, we invite connections to supporting teachers at any grade level to deepen attention to the details of children’s mathematical thinking and the varied resources they bring to the classroom.